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Innovative IoT-based intelligent smart cup coaster for enhanced beverage experience

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Abstract

The Innovative IoT-Based Intelligent Smart Cup Coaster presented in this research introduces a transformative approach to the traditional beverage coaster by seamlessly integrating cutting-edge Internet of Things (IoT) technology. This intelligent coaster is designed to enhance the overall beverage experience, addressing the limitations of conventional coasters. Equipped with temperature, weight, and proximity sensors, the smart cup coaster communicates wirelessly with a dedicated mobile application, allowing users to personalize and control various aspects of their beverage enjoyment. Features such as real-time temperature control, weight sensing, proximity awareness, customizable LED lighting, and integration with virtual assistants redefine the user experience. By leveraging IoT capabilities, this smart coaster not only elevates the functionality of a commonplace object but also offers valuable insights into consumption patterns, encouraging hydration and providing a dynamic and interactive beverage experience for modern consumers.

Keywords: Node MCU 8266; Temperature Sensor; Micro Controller; Proximity Sensor

1. Introduction

The integration of the Internet of Things (IoT) has completely changed how we connect with common objects in today's age of technological breakthroughs. To redefine the conventional notion of beverage coasters, our research presents an Innovative IoT-Based Intelligent Smart Cup Coaster in this context. Our clever smart cup coaster uses advanced sensors and connections to deliver a dynamic and customized beverage experience, in contrast to traditional coasters that have a single function. This smart coaster serves as a link between the physical world of drinking and the virtual one as customers look for more seamless technological integration in their daily lives. By incorporating functionalities such as customizable LED lighting, weight sensing, proximity awareness, real-time temperature control, and virtual assistant integration, this innovation not only overcomes the shortcomings of current systems but also anticipates and meets the changing needs of contemporary users. This introduction lays the groundwork for a discussion of the main characteristics and capabilities of our Internet of Things (IoT) smart cup coaster, emphasizing how it may improve and change the way we enjoy our favorite beverages.

2. Literature survey

The new generation of web tools called recommender systems makes it easier for consumers to surf the internet and learn more about the content they are interested in Comparatively speaking, using an internet recommender is a quick and hand way to make purchases. It helps to assist consumers in choosing the appropriate products, and these recommendation systems are essential for e-commerce websites. [Saquib Sohail's. 2019].

It assists users in selecting the ideal book for them. [Mounika, V. (2020, January)] The scientific community has become increasingly interested in the recommender system study due to its exponential growth.

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[Rahman, M.A. (2021)].By eliminating information overload and giving consumers what they need, these solutions are tremendously helpful E-commerce, online auctions, and the recommendation of books and conferences for academics and business people are the main areas where recommender systems have made a substantial contribution.

We anticipate that our study will be extremely useful to scholars looking into recommendation technology in general and book recommendation in particular. [Kaleli,C. (2019)].

The BX books dataset is utilized in the system for recommending books. Collective selection and material-based sorting systems have both employed the suggestion method as a selection strategy. [Ijaz, F. (2020)]

A category of information filtering systems are recommender systems. [Valean, H. (2020)] These systems are specialized software parts that are typically included in bigger software systems but may also be used independently.

A scientific study of statistical models and algorithms is known as machine learning. K-NN and matrix factorization are two machine learning methods I'll be using in this study[Anwar, K., &Sohail, S. S. (2020)].

The suggested method uses data mining techniques to identify trends among the courses. [Obeidat, R., Duwairi, R., (2019)]. As a result, we have found that, as compared to association rules produced using the entire collection of courses and students, grouping students into comparable groups based on their individual course preferences play a crucial role in producing high-quality association rules.

Searching for the proper book or books, research papers in journals, and articles are among the many tasks. Utilizing collaborative and content-based filtering techniques, the library recommender system sorts out the library's materials. [Kolhe, S. R. (2018].

The current study presents a novel recommendation system built using machine learning techniques. [Mohammad, A. (2021)]. Recommender systems (RSs) are now often utilized in e-commerce, entertainment, and search engines.

3. Methodology

3.1. Problem Statement

The IoT smart cup coaster project addresses several challenges in the quest to enhance the traditional beverage coaster into an intelligent, connected device. One of the primary issues is the need for precise and reliable sensors to accurately monitor both the temperature of the beverage and the liquid level in the cup. Achieving this level of accuracy poses a technical challenge, especially in various environmental conditions. Another challenge lies in optimizing power consumption to ensure the longevity of the coaster's operation. Balancing the need for real-time monitoring and user interactivity with a sustainable power source, such as batteries, requires careful consideration. The integration of connectivity modules and the development of a user-friendly mobile application introduce challenges related to data security and privacy. Ensuring that user data is handled securely, both in transit and storage, is crucial for the success and acceptance of the IoT smart cup coaster. Moreover, the project aims to implement machine learning algorithms for personalized user experiences, introducing complexities related to algorithm training, real-time adaptation, and scalability. The coaster must effectively learn and adapt to individual preferences without compromising efficiency or responsiveness. The successful resolution of these challenges will not only contribute to the creation of a reliable and user-friendly IoT smart cup coaster but will also pave the way for advancements in the broader field of Internet of Things applications for everyday objects. The project serves as an opportunity to address these technical hurdles, fostering innovation and improving the overall user experience in the realm of smart and connected devices.

3.2. Existing System

The existing system of an IoT smart cup coaster typically involves a combination of sensors, microcontrollers, and connectivity modules to create an intelligent and interactive coaster for beverage containers. These coasters are designed to enhance user experience by incorporating various features such as temperature monitoring, liquid level detection, and connectivity with mobile applications. The coaster is equipped with temperature sensors to detect the temperature of the beverage placed on it, ensuring that it stays within the desired range. Additionally, liquid level sensors enable the coaster to monitor the amount of liquid remaining in the cup. The collected data is then processed by an embedded microcontroller, which communicates with other devices through wireless connectivity protocols such as Wi-Fi or Bluetooth. Users can interact with the coaster and receive real-time information about their drink via a dedicated mobile app, allowing for a more personalized and convenient beverage experience. Overall, the existing

system of an IoT smart cup coaster integrates a range of technologies to provide a seamless and intelligent solution for beverage enthusiasts.

3.3. Proposed System

The proposed system for an IoT smart cup coaster envisions an advanced and enhanced version of the existing technology, incorporating innovative features to further enrich the user experience. The upgraded smart cup coaster will maintain its core functionalities, such as temperature monitoring and liquid level detection while introducing new elements to meet evolving user needs. In the proposed system, additional sensors, such as ambient light or proximity detectors, may be integrated to offer more comprehensive environmental awareness. Moreover, the coaster could incorporate machine learning algorithms to analyze user preferences over time, enabling it to suggest optimal temperature settings or personalized beverage recommendations. Enhanced connectivity options, including integration with smart home ecosystems or cloud services, may be explored to broaden the coaster's capabilities and allow for remote monitoring and control. The proposed system aims to provide a more intelligent, adaptive, and interconnected solution, ensuring that the IoT smart cup coaster remains at the forefront of technology in delivering a seamless and customizable beverage experience.

4. Implementation Kit

4.1. Hardware

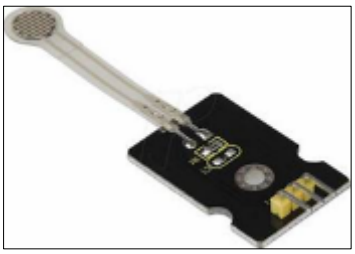

Figure 1 Pressure Sensor

An innovative solution with a wide range of useful applications is provided by integrating pressure sensors into a smart cup coaster, especially in the areas of beverage consumption and smart home technology. The liquid level can be monitored in real-time by integrating pressure sensors into the surface of the coaster to sense the weight and pressure of a glass or cup put on it. To make sure they never forget to replenish, this function lets customers receive alerts or messages when their beverage is going low. Furthermore, the coaster can be equipped with temperature sensors to track the temperature of the beverage and notify users in real-time of how warm or cold their drink is. When combined with Internet of Things technology, pressure sensor data can also be used to monitor beverage consumption trends and provide tailored suggestions for related items or beverages. To further improve user experience, the coaster can be fitted with interactive LED indications that flash or change color in response to the amount of pressure applied. Pressure sensor-enabled smart cup coasters are a useful addition to smart home ecosystems because they improve convenience, personalization, and connection in daily beverage routines.

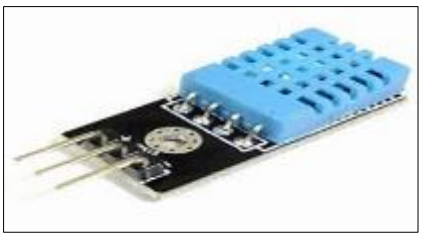

Figure 2 Temperature Sensor

A smart cup coaster that incorporates a temperature sensor offers many cutting-edge features that improve the experience of drinking beverages. Users can now keep an eye on the temperature of their drink in real time thanks to the sensor that is embedded into the coaster's surface. Whether it's a cool iced beverage or a steaming hot cup of coffee, this feature makes sure that the liquids are enjoyed at the perfect temperature. Users can receive immediate feedback and notifications if the temperature of their drink deviates from their preferred level thanks to the temperature sensor's

ability to communicate with a connected app. To ensure the best possible beverage pleasure, the coaster can also be set to change ambient lighting or turn on heating or cooling elements based on temperature sensors. In addition, the incorporation of temperature sensor technology allows customers to monitor temperature trends over time, offering insightful data on beverage preferences and consumption habits. For consumers looking to have the ideal beverage experience, the addition of a temperature sensor to a smart cup coaster improves ease, personalization, and enjoyment overall.

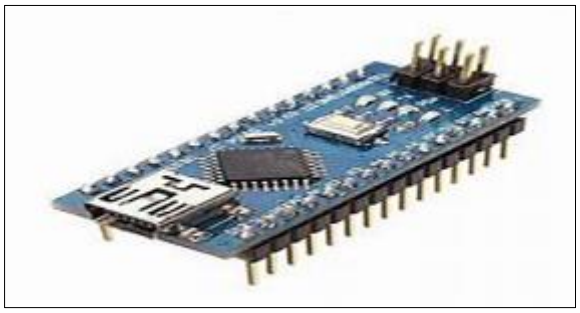

Figure 3 Microcontroller

The addition of intelligence and interactivity to a smart cup coaster through the integration of a microcontroller such as Arduino enhances the device's functionality and improves user experience. By utilizing Arduino, the coaster may be transformed into an advanced Internet of Things (iot) hub that can gather and analyze data from several sensors, such as pressure and temperature sensors, to track temperature, beverage levels, and even human activity. The coaster can be seamlessly integrated into current smart home ecosystems thanks to the microcontroller's ability to interface with other smart devices or platforms. Through voice commands or a connected smartphone, users may engage with the coaster and enjoy services like automated beverage restocking, real-time temperature monitoring, and personalized suggestions based on use trends. Furthermore, developers can tailor the coaster's functionality to specific needs or use cases thanks to Arduino's programmability and flexibility. This includes changing the LED indicators, adding interactive touch controls, and integrating with outside services for more functionality. All things considered, the incorporation of Arduino into a smart cup coaster makes it an all-around adaptable and clever tool that improves connectivity, ease, and personalization during tbeverage- consuming process.

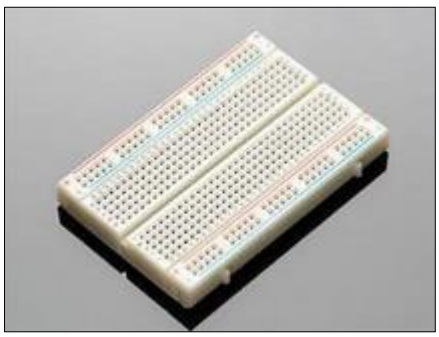

Figure 4 Breadboard

By combining an IoT project with a breadboard and smart cup coaster, a creative platform for improving drinking experiences with electronics prototyping is created. The smart cup coaster's IoT integration allows users to experiment with a variety of customizable and interactive features by connecting it to a breadboard. The temperature and pressure sensors built into the smart cup coaster provide real-time beverage condition monitoring, guaranteeing maximum pleasure. To improve the coaster's functionality, users can experiment with different sensors, actuators, and microcontrollers using the breadboard, which is a flexible platform for electronics experimentation. Data gathered from the coaster's sensors can be sent to the breadboard for processing and interaction with other electronic parts via IoT connectivity. With this configuration, it is possible to create customized beverage experiences by triggering actions like automated beverage reordering based on consumption patterns or altering LED indications based on beverage temperature. This IoT project is a flexible and entertaining platform for both beverage enthusiasts and electronics

hobbyists. Users can also experiment with various electronic components and programming approaches on the breadboard to explore educational opportunities.

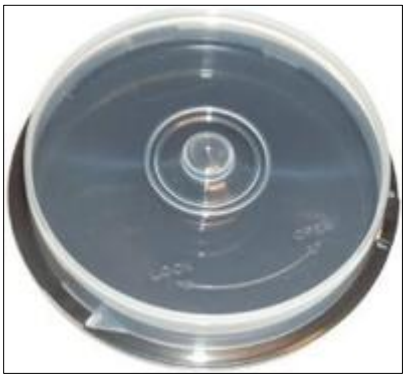

Figure 5 Cake Boxes

4.2. Schema and Block Diagram

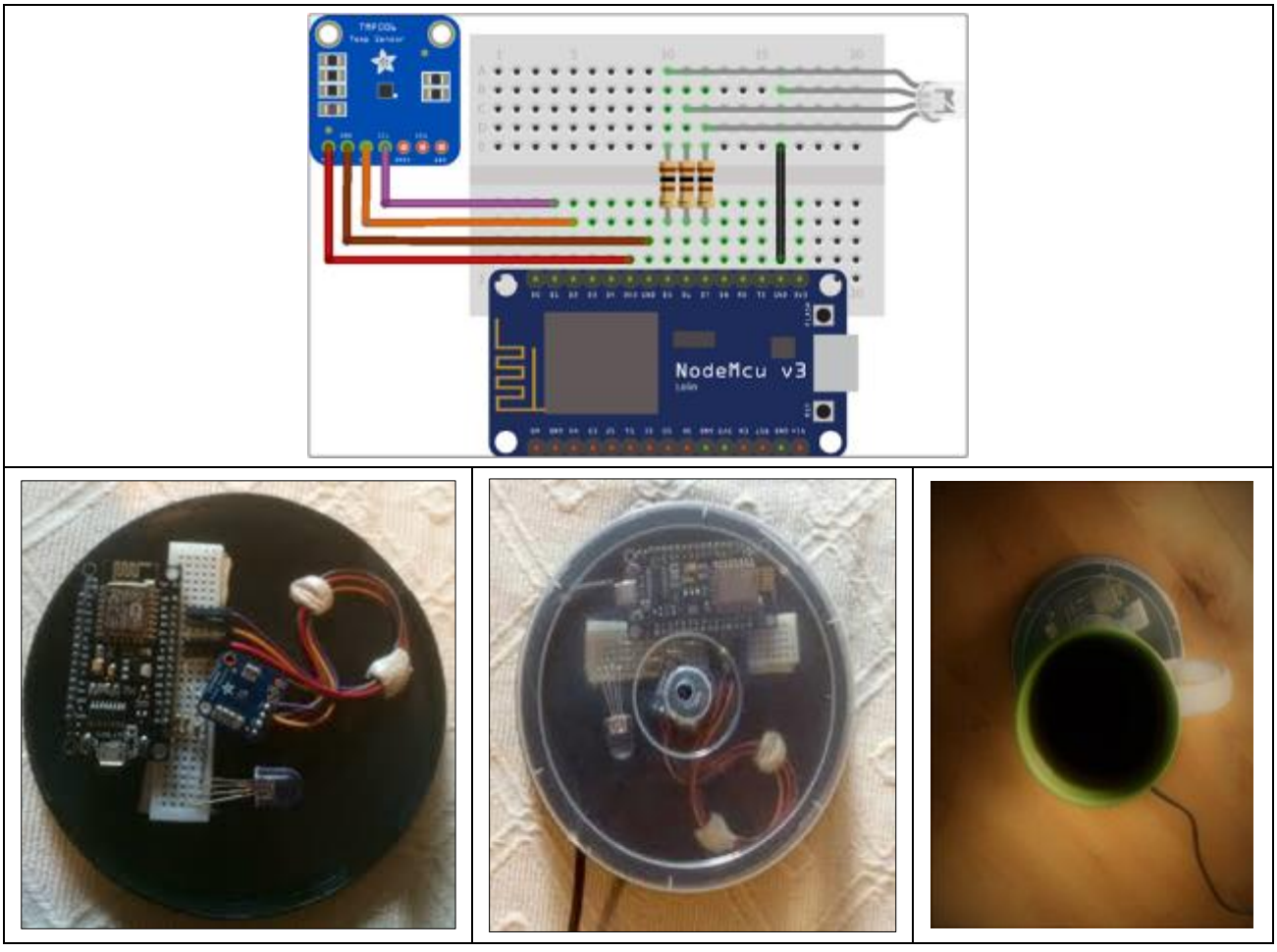

Figure 6 Recommend book name

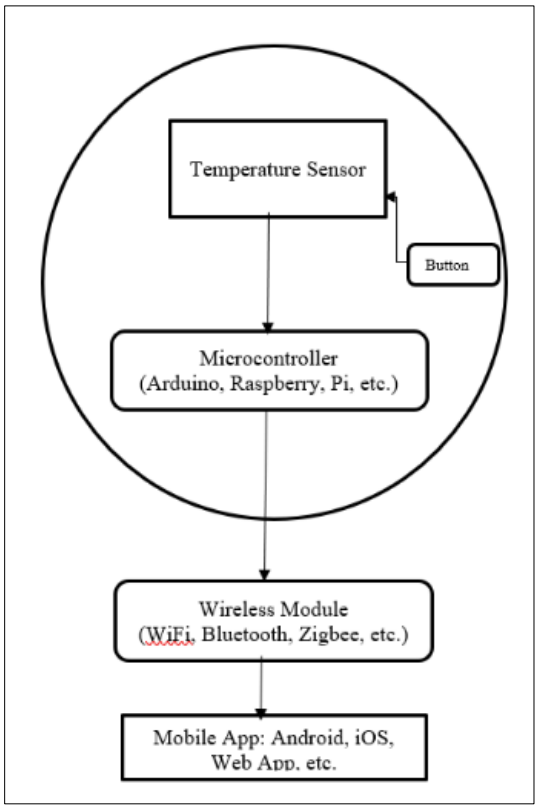

Figure 7 Diagram of Smart Cup Coster

5. Results

Upon the successful implementation of the IoT smart cup coaster project, the results showcase a technologically advanced and user-centric beverage experience. The coaster effectively monitors the temperature of the beverage, ensuring it remains at the desired level, and accurately detects the liquid level in the cup. The integration of additional sensors, such as ambient light and proximity detectors, enhances the coaster's environmental awareness and responsiveness. Users can interact seamlessly with the coaster through a dedicated mobile application, receiving real-time updates and enjoying personalized control over their drinking preferences.he machine learning algorithms incorporated into the coaster contribute to a more intelligent system, learning and adapting to user preferences over time. This feature allows the coaster to provide personalized recommendations and optimize temperature settings based on individual tastes. The connectivity modules enable the coaster to communicate wirelessly with other devices, facilitating remote monitoring and control, even integrating with smart home ecosystems or cloud services. The project's success is not only evident in the coaster's technical capabilities but also in its ability to deliver a truly immersive and customizable beverage experience. The implementation demonstrates the potential of IoT technology to transform everyday objects into intelligent, interconnected devices, offering users a blend of convenience, personalization, and cutting-edge innovation in their daily lives. Overall, the IoT smart cup coaster project yields a tangible and impactful result, setting the stage for continued advancements in the realm of smart and connected devices.

6. Conclusion

In this study, a model trained using the collaborative filtering technique K-Means Clustering was used to recommend books to a user. The more than 3000 books in the book dataset that is available on Kaggle. Using the K-Nearest neighbor technique, the models are created. The author created a model that provides a high Silhouette score based on those characteristics. The suggested model in this research is beneficial to book readers. The algorithm is created can also provide recommendations for brand-new user. In this research, we describe a recommendation system based on collaborative filtering. The main objective was to speed up suggestions, which is to design a system that can give customers high-quality recommendations without requiring them to register for an extended period of time and have an excellent profile experience, browsing history, etc. According to test results, the suggested strategy offers sound advice. The suggested action can be used in various fields to advertise items like movies, music, and other goods. We have developed a machine learning model to recommend books, and now we must develop a Python function. In

conclusion, the IoT Smart Cup Coaster project represents a significant advancement in integrating IoT technology with everyday objects. By seamlessly blending sensors, communication protocols, and user interfaces, the coaster offers a convenient and intuitive solution for monitoring beverage temperature and presence. Through meticulous software configuration, we've ensured robust data processing, secure communication, and remote management capabilities, enhancing the overall user experience. This project underscores the potential of IoT to enhance convenience and efficiency in daily life, paving the way for further innovation in smart device integration.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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Author short Biography

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