A Review of Intelligent IoT Applications & Challenges

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Abstract

Internet of Things (IoT) technology is enabling our everyday lives to be more efficient and cost-effective by connecting everyday objects to the internet. By using sensors and actuators, IoT technology enables these everyday objects to be monitored and/or controlled remotely, collecting and sending data which can be used to automate or analyze processes. For example, fire detectors in a building can be connected to the internet and used to trigger an alarm or notify the fire safety team in the event of an emergency. The data collected from sensors connected to the Internet of Things (IoT) is used to make better decisions by analyzing and manipulating the data. This involves using advanced algorithms to detect patterns and trends in the data, as well as to identify any anomalies. This data can then be used to make predictions about how various devices or systems are likely to behave, thus triggering automated reactions or proactive corrections as needed. For example, a smart thermostat can use data from temperature sensors to predict and adjust the heating of a building to maintain an optimal temperature level. In the current online grocery shopping environment, it is important for someone handling the kitchen to keep track of their groceries. Without proper tracking and storage, the person handling kitchen may find themselves running out of ingredients before they have time to purchase more, leading to an insufficient supply of items needed to cook. The system described in this paper aims to reduce the workload of the person handling the kitchen by automating the tracking of the groceries purchased online. By connecting the grocery items to the internet, the system will be able to monitor when an item is running low and automatically order a replacement item. This would eliminate the need for the person handling the kitchen to manually compare purchase lists and order replenishments, saving valuable time and energy. The objective of this paper is to propose a system which utilizes Internet of Things (IoT) technology to track the availability of groceries in the kitchen. This system would include sensors and actuators connected to each grocery item, with the data from these sensors feeding into an artificial intelligence (AI) algorithm. The AI algorithm would continually monitor the inventory of the kitchen, providing alerts when items are running low. This system would also be able to predict future usage of groceries, allowing for automatic restocking from online stores as needed.

Keywords: IoT, Smart Home, Smart Kitchen, AI

Introduction

Internet of Things (IoT) is a technology that allows for better human-to-machine and machine-to-machine interactions by connecting everyday items, such as appliances and devices, to the internet [1]. By using sensors and actuators, these items can be monitored and/or controlled remotely, allowing for greater control and efficiency. For example, IoT technology can be used to automate buildings for better energy efficiency, or to provide data to optimize traffic patterns for shorter and safer commutes. IoT technology can also be used for medical and healthcare purposes, such as to provide remote patient monitoring, or to track and store medical records more securely. Overall, IoT is quickly revolutionizing the way humans and machines interact. Internet of Things (IoT) is a technology in which everyday items, both living and non-living, are given a unique identifier. These identifiers then connect the item to the internet, allowing them to be tracked and controlled remotely. This technology is being used to automate various business processes and has already seen notable success in various sectors, such as manufacturing, transportation, healthcare, and energy. Through the utilization of sensors, networks, and communication protocols, machines can communicate and exchange data independently of human input. This machine-to-machine (M2M) technology can be used to automate various operations, such as industrial automation, remote monitoring, and security surveillance. By allowing machines to process data, control operations, and diagnose faults remotely, M2M communication can save time and expense associated with manual operations. This is called Machine-to-Machine (M2M) communication. It is a process in which two machines connected to each other can exchange data without any human interference. M2M communication is made possible by using sensors, networking technologies and communication protocols [2]. This allows machines to identify each other, interact and exchange data without any direction or manual input from humans. It is used in various applications like industrial automation, remote monitoring, security surveillance and more. In these applications, machines with internet connectivity can be automated and produce real-time data that can be collected, analyzed, and processed by remote applications. This technology has a great advantage of allowing machines to handle data processing, control operations, diagnose faults and alert users remotely to

save time and cost associated with manual operations. The concept of smart devices started to emerge in 1982 with the introduction of the US Department of Defense's Advanced Research Projects Agency Network (ARPANET). The development of this digital communication network allowed for the integration of computers, sensors, and controllers. This lead to the ability for computers to communicate with each other, as well as the development of automation and remote control operations. This allowed for machines to process data, diagnose issues, and control operations automatically. The first such machines were developed in the early 1980s and were used in manufacturing plants and industrial control systems, leading to the development of the "smart device" concept. From there, the technology advanced, leading to the proliferation of the Internet and the development of the Information Age [3].

Smart devices are electronic devices that are capable of communicating with other devices and performing automated tasks, often using sensors, software, actuators, and networking connectivity. Smart devices are able to detect changes in the environment and respond accordingly to complete tasks or deliver services. Common examples of smart devices include smart phones, home automation systems, and smart TVs. Smart devices are primarily used for convenience and to make everyday tasks easier [4]. For example, many homes are equipped with smart lighting systems, which turn on and off automatically based on occupancy in the house, or a robotic vacuum cleaner which can be programmed to clean a specific area autonomously [5].

Women now live in a time where they can break barriers and strive towards achieving their fullest potential. By entering multiple sectors of industry, they are making a mark and taking charge of their lives. Women in the workforce are contributing to the economic growth in profound ways- finding jobs and careers to match their needs and interests, offering insight and perspectives that allow businesses to evolve, and pushing for the gender wage gap to decrease [6].Women have been playing a larger role in the day to day responsibilities in their households as well. Pieces of research suggest that the division of housework and childcare is becoming more equal than in previous generations, which is empowering women to take on greater roles in their homes. Women are now able to balance their working responsibilities and family roles in ways that meet their needs. And with smart devices, like Alexa, completing chores quickly and efficiently helps them manage their time effectively [7].

In the past, the purchase of household items such as groceries and other fast moving goods was done by physically going to a store or mall to buy the items needed. It usually required a lot of time and effort, from searching for the best deal to actually loading the bags into your car. Given the odds of these shopping trips, some women often had to choose between other responsibilities and taking care of errands. Now, with the

advancement of technology, women are able to purchase their needed items quickly and efficiently through online shopping [8]. With the help of various apps and websites, purchasing groceries, clothes and other items is made easier. Women no longer need to waste their time going to stores to buy items as they can have them delivered to their home with just a click of a button. This has given them more time to focus on other tasks and responsibilities. People still need to keep track of their grocery stock manually. For instance, some people prefer to keep a running tally of their pantry's contents and make a list before shopping online. This is done to ensure that all the items needed are purchased and avoid unnecessarily wasting time to reorder items on a different day [9].

This paper proposes an automated system for purchasing household grocery items. The system would connect an IoT to the customer's home to detect when an item is running low and place an order for a replacement. By having all purchases automated and connected, users would not have to manually track the stock of their grocery items, avoiding wasted time and money. This system would improve convenience and help maintain a steady supply of items [10]. By connecting an IoT to the customers' home, it senses the low level of items and automatically places an order for a replacement. This also helps to save time and money as one will not have to manually track the stock of their grocery items. Moreover, customers can enjoy the freedom of receiving their desired items at the door without having to worry about the timely shopping.

The system can be evaluated based on the speed of purchase decisions, the accuracy of item selection, and the cost of the system [11]. The speed of the decisions would depend on the processing power of the system and the speed of delivery from the store. The accuracy of item selection would be checked by comparing the chosen items with the customer's previously indicated preferences. The cost of the system would depend on the hardware and software components needed to build the system. The automated system for purchasing household grocery items brings advantages by eliminating the need to manually track items when stock is running low and providing customers with timely and accurate deliveries. While there are further research needs in order to make the system more reliable and effective, the proposed system offers a promising solution to improve convenience and help maintain a steady supply of items in the households [12].

An online grocery backup management system can be highly beneficial for working women, as it allows them to easily manage their grocery stock and plan out their purchases in advance. It provides them with the flexibility to order items in bulk and get them delivered as per their convenience [13]. It also helps the seller and manufacturer in optimizing their products' availability and strengthening their supply chain. The data generated through the system can be used to understand the

purchasing trends of customers, the demands of goods, and the sales patterns of products, allowing them to make better decisions in terms of inventory management and product placement [14].

Related Research

A systematic approach of attaching sensors to all appliances is employed to establish a connection with the main computer system, thereby allowing them to effectively communicate with one another. These sensors alert the owner when groceries are running low and remind them to make their purchase. Furthermore, customers can even avail discounted prices based on their consumption pattern [15,16]. It helps them to keep a track of their grocery expenses. Additionally, it eliminates the hassles associated with grocery shopping as customers do not need to visit the stores or wait for their delivery. It also eliminates the problem of wastage due to overbuying or expired products, leading to cost optimization. Overall, online grocery backup management system provides multiple advantages to the working women, including convenience, cost optimization, accuracy, and sustainability. It could be a great way to address the challenges women face and help them manage their time and resources more efficiently [17,18].

Current & Future Approach Methods

In a system of connected appliances, a message queue is used to facilitate communication between devices. Through the message queue, each appliance's sensors will send data to the master computer few seconds. The master computer then uses this data to adjust the appliance's settings accordingly, creating a system of connected appliances that are able to respond to each other [19]. This helps to make the system more efficient and cost-effective, as well as enabling the appliances to exchange information without having to rely on human input [20].

In South Korea, a virtual store has been created and installed on subway systems. Passengers can purchase products by scanning two-dimensional bar codes with their phones or scanners. These codes are seen on various monitors in the metro station. The payments are processed through a digital payment system and the order is sent to the station shop, where customers can pick up their goods [21]. This virtual supermarket provides travellers the opportunity to buy what they need without the need to carry it around with them, in a simple and convenient manner. These QR codes are visible on various displays around the metro station. The payment is made using a digital payment system and the order is directly sent to the station store where shoppers can pick up the items from there. This virtual supermarket setup provides travellers the convenience to purchase their everyday items, without having to carry with them, in a very easy and convenient manner [22].Most gadgets on the market are designed and developed independently by different companies. This means that they lack any kind of standard architecture, making it difficult to integrate

the gadget's hardware and software with other products and services. As a result, users must spend time figuring out how to use the gadget, or how to sync it with other products and services. The Raspberry Pi, on the other hand, uses an open source architecture that allows anyone to create applications and hardware solutions with it. This makes it easier for users to customize components, sync the device and integrate it into their existing projects [23]. This lack of knowledge leaves a gap in research on the effectiveness of IoT in choice modelling. Therefore, a study of the impact of wearables on choice modelling would give key insights into the impact of IoT on decision making process. Furthermore, by investigating the real-time features of IoT, it could be judged if the IoT device provides improving choice modelling qualities over traditional techniques [24].

The findings from such a study would be especially beneficial in areas such as sports performance, healthcare, online gaming and entertainment and transportation. Sports performance would benefit from IoT technology as it could provide keen insights into an athlete's physical state, providing a comprehensive overview of the athlete's stance and motion speed [25]. The healthcare sector would also benefit from understanding an individual's real-time health and state, allowing monitoring and timely intervention if necessary. Online gaming and entertainment too could benefit from real-time input of user motion, allowing for more tailored and immersive experiences that directly respond to the user's situation. Lastly, transportation would be improved as safety implications could be accurately tracked and responded to with in-time measures. As a result, this study would create an understanding of the impact of IoT wearables on choice modelling, as well as how these devices can effectively be used in various environments. This would help create a more comprehensive understanding of the applications of this technology and how it can benefit a variety of fields.

Conclusion

By utilizing sensors, the system generates real-time data on the availability of the items in the kitchen and create an accurate inventory of items, which allow for more efficient groceries shopping. Additionally, the data collected from the sensors provide insights into the daily usage of the items, which provides a better understanding of what items are needed to be replaced more frequently than other items. With this system, the kitchen can always remain stocked with frequently used items, reducing the need for excessive or unnecessary purchases. This system also can be beneficial in locations such as supermarkets, online stores and restaurants as it can accurately provide efficient tracking and management of their stock and ordering needs.

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