

Australian Government**IP Australia**

Innovation Patent Australia

Title of the Invention: - Smart Refrigerator using IoT and Intelligent Cloud for Life Expedience.

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COMPLETE SPECIFICATION

FIELD OF THE INVENTION

Our Invention Smart Refrigerator using IoT and Intelligent Cloud for Life Expedience is related to aIntelligent Cloud & Internet of Things.

BACKGROUND OF THE INVENTION

The Technology that's buzzing around now is cloud computing which is driven by major software tech giants like google, Amazon and Microsoft. Several service models have emerged right now after the rapid growth of cloud. Services vary and are tuned based on the need of clients. The cloud service providers have built enormous infrastructure to provide uninterrupted and efficient services by utilizing the potential and expanded internet all over the world. Services are provided on demand and on subscription basis. Cloud infrastructure includes database, development platform, high performance computing environment and applications tailored to heterogenous users. Users can save enormous expenditure by adopting to cloud and takes minimal efforts for transition as the base requirement is internet. The users can pay based on pay per use model facility. The cloud can be described as a distributed network that facilitates virtual resources using standard access protocols.

Computers can learn themselves using Machine Learning which fast growing technology that utilizes the past data. Mathematical models are built using several algorithms for prediction using past data by machine learning. The tasks that consumed huge time in past like image processing, speech recognition, facial recognition etc. can be done at ease using machine learning and with high accuracy. Machine learning can be used to teach computer naturally like the humans and animals based on experience. The machine learning algorithms are used to learn directly without depending on preset equation as a model. The performance of algorithms depends on the number of samples that are utilized in learning.

Machine learning concepts are based on computer learning experience from the huge sample datasets available from past data collection. Revolutionary results are obtained in cloud infrastructure with the integration of this machine learning and the cloud computing. This evolution of cloud and machine learning has given rise to a technological exploding domain called as Intelligent Cloud. Cloud evolved as medium for providing various services

on demand like storage, networking, platform, applications etc. The capabilities of cloud increased and strengthened with the infusion of machine learning. As machine learning is dependent of huge volume of data to learn, its thrust is fulfilled by the enormous data present in the cloud. Accuracy of results is also increased meticulously. It will also assist in apt analysis of heterogeneous circumstances. Machine learning requires huge computing power for quick processing and cloud is the right place overcoming need for users to buy or expand existing infrastructure. Variety of applications are possible using the intelligent cloud technology that was not possible in traditional technology landscape.

The most important technological innovation happened over few years is Internet of things (IoT) in the 21st century. A plethora of devices can be connected using internet for a variety of applications ranging from home, hospitals to city. The applications could be in kitchen, surgeries, security, cleaning etc. to name a few. The devices can collect and communicate with other devices seamlessly using internet for sharing data and analysis. IoT devices have become the eyes and ears of humans and monitor the places that was not possible earlier without being physically available there. Enormous data is generated from these devices that see, hear, or sense the happening around their environment. This data is shared and stored for analyzing and getting the desired results of automation or action. The devices availability has increased and have become less expensive over years resulting in huge usage and employability.

The Refrigerator cools the internals by extracting the heat from the items inside and releasing the heat to the air outside. This task is accomplished by the freon gas which tosses through a circuit moving to condenser from the evaporator. The freon is warmed in the evaporator at the start which rests in insulated cabinet. As freon is designed to boil, it extracts the heat from air inside refrigerator. The condenser is then passed with this heated freon that has heat absorbed. The heated freon changes to liquid state in the copper coils transferring the heat to outside air of the refrigerator. Once cooled the freon goes back to the evaporator which is again passed to the same process for absorbing the heat from the food items that are placed inside the Refrigerator. The condenser and the evaporator sections of the refrigerator can also be fitted to metal fins for acquiring more surface area. A coil is wrapped around the freezer unit to achieve defrosting. As defrost is reached by the timer unit, the refrigerant is passed through this coil in hot state to raise the temperature to melt the ice. This is typical working state of the refrigerators.

SUMMARY OF INVENTION

Smart Refrigerator based on IoT and Intelligent Cloud for Life Expedience (SRIIC) is a smart refrigerator that uses IoT technology and is connected to the Intelligent Cloud for data storage and processing. The system consists of a central processor connected with cameras and weighing sensors in each shelf and jars that are swappable and are used for storing food items. The refrigerator can also be used without jars as per user convenience but some function like auto weight calculation may not be available. All the information like items present inside, recipes, quantity etc. from the system can be displayed on the led display attached to front door. The weight of food items is calculated and stored on the cloud. When the items are about to finish, they can be automatically ordered by the system online. The food item can be checked from the app through cloud anywhere. When a food item is about to expire then the system alerts well before to avoid the food wastage. The food items in the jar are recognized using intelligent cloud technology by capturing the images of items stored in the refrigerator. Machine Learning plays a vital role in processing data in the cloud. Based on the food items and the cuisine selected by the user, the data from cloud is used to suggest recipes.

Electricity consumption can be reduced by huge margin by avoiding the frequent opening of the door by user to simply check the contents of refrigerator as all the contents are displayed on the door display. The smart refrigerator automatically senses the user near the refrigerator and display the contents without the need of user intervention. The energy efficiency can also be improved by timely cleaning of refrigerator as alerted by the system on schedule. The smart refrigerator auto cools inside by sensing the temperature outside the refrigerator and based on seasons in a region.

OBJECTIVE OF THE INVENTION

The objective of Smart Refrigerator based on IoT and Intelligent Cloud for Life Expedience (SRIIC) is to make the life of people easier and smarter as part of smart home ecosystem by suggesting the recipes based on user choice of cuisine. Avoid enormous food wastage from spoiled food items that are caused due to expiry and reduce electricity consumption that may be due to low performance caused by irregular or no cleaning of the refrigerator. Avoid frequent opening of refrigerator for checking of food items that may also lead to low performance and high electricity consumption.

Existing and Proposed approaches

Existing approach

- a. Refrigerators have been around for 100 years and have functioned just fine without any or very minimal smart features.
- b. Enormous amount of food is wasted that gets spoiled remaining in refrigerator for many days
- c. User can't quickly decide what can be made with the items they brought or left in the refrigerator leading to spoiling of food items.
- d. User often forgets food items to purchase and travel more to get them wasting lot of time and fuel.
- e. User often frequently open the refrigerator to just check what items are available in the refrigerator and their quantity left thereby causing performance issues and leading to more electricity consumption.
- f. Electricity consumption may also increase due to low performance caused because of not cleaning the refrigerator in time.
- g. Lot of food items get spoiled due to incorrect temperature setting by the user.

Proposed Approach:

- a. Smart Refrigerator with machine learning and IoT capabilities connected to intelligent cloud service for data storage and processing.
- b. The SRIIC consists of a central processor connected with cameras and weighing sensors in each shelf and jars that are swappable and are used for storing food items.
- c. The system has an interactive display attached to front door to show all information like quantity of food items, food expiry, recipes etc.
- d. Weighing sensor attached to each jar in a shelf calculates the weight of item stored in jar and stores the data in cloud.
- e. Camera in shelf for each jar are used to capture the image of food item and send the data to cloud for processing and recognizing the item using Machine Learning
- f. When a user is detected near the refrigerator, the smart system displays list of all items present in the refrigerator with quantity and freshness.
- g. All the items present in the refrigerator are used to suggest recipes to user on the display based on user choice of cuisine.

- h. Alerts are given to the user when an item in the refrigerator is about to finish or expire.
- i. All food items can be automatically ordered from the nearest grocery store or online using the cloud service that are about to finish based on need of the user.
- j. The user can check the items present in the refrigerator from anywhere, anytime using SRIIC cloud services.
- k. Only specific jar is highlighted with LED based on user selection of food item from the display on front door for quick jar selection in any lighting condition.
- l. Alert is given to the user when the refrigerator needs timely cleaning for long durability.
- m. The smart refrigerator automatically adjusts the cooling by sensing the temperature outside the refrigerator and based on the seasons

BRIEF DESCRIPTION OF THE DIAGRAM

Figure 1: Block Diagram of Smart Yoga Assistant Mirror using IOT & Computer Vision for Healthy Life

Figure 2: User Identification using Facial Recognition

Figure 3: User Interaction with Smart Yoga Assistant Mirror using IOT & Computer Vision for Healthy Life

Figure 4: Monitoring Yoga Asana using Computer Vision

Figure 5: Emergency alarm based on user fall or help request

DESCRIPTION OF THE INVENTION

The SRIIC is based on IoT and Intelligent cloud technologies. IoT technology is used for data collection, monitoring and efficient working of Smart Refrigerator and Intelligent cloud is used for data storage and processing. The system consists of a central processor (CPU) connected with cameras and weighing sensors in each shelf and jars that are swappable and are used for storing food items. Camera and LED are placed above each jar in the refrigerator. As most food items are stored in plastic bags or boxes in the refrigerator, the jars could be very useful in storage. All the jars are well spaced for efficient cooling.

When food items are stored in the jar, the weighing sensors attached to the jar calculates the weight of food item stored and sent the data to the cloud using Wi-Fi connection. The food item images are captured by the camera placed above each jar section and sent to the cloud. The intelligent cloud uses machine learning algorithms to recognize the food item and stores the information of the item recognized along with quantity and expiry data calculated based on food item or as provided by the user. When the user comes near the refrigerator the list of items available are displayed to the user on the front door along with quantity and expiry. The user need not open the refrigerator frequently jut to check the food items available. The user can also use the mobile app connected to the cloud to check the food items available in the refrigerator anytime and anywhere.

The SRIIC system provides recipes to the user based on the type of cuisine choice of the user on the refrigerator display. The user can also any food item which is not available using the interactive display. The system can also order food items automatically from online or nearby grocery stores based on user choice. When the user wants to take any food item from the smart refrigerator, then the system highlights only that specific jar using LED after selecting the item from list on front display. This feature saves time in searching where that food item is stored. This is also very useful in the night. When the items are about to expire or finish an alert is sent to the user well before. The cooling temperature can be auto set based on the temperature outside the refrigerator and weather condition in various seasons of that region. The energy efficiency can also be improved by timely cleaning of refrigerator as alerted by the system on schedule. The data stored in cloud can be used for analyzing the food habits of the user. They provide the week or month or year wise summary for the user.