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SECP1513 – TECHNOLOGY INFORMATION SYSTEM
SECTION 08
PROJECT – PHASE 1 (PROJECT PROPOSAL)
[SMART WARDROBE]

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6. Content should be organized under **appropriate headings**.
7. **Different points** are required to be explained in **different paragraphs**.
8. **Tables, diagram, and charts** should be labelled.
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INTRODUCTION

1.1 Overview of Project

Smart wardrobe may be a system that's capable of analysing the information at hand and making a choice on what must be done to support that information. To supply easy and convenient garment maintenance, a wise wardrobe facilitates users to manage owned garments, dry, refresh and sanitize clothes, steam, and deodorize them before the subsequent wear within the wardrobe. The mobile application that permits control of the wardrobe's functionalities can provide users with suggestions on planning outfits. Additionally, by incorporating a measure of intelligence into the resulting system, the system requires less input from the user and scales back waiting time as the process progresses. Users are able to tailor certain features per their needs or opt for an automatic combination of all functions using the appliance provided.

The interactions between the smart wardrobe and the user are similar to those which occur between a user and a manual wardrobe. The difference is that the smart wardrobe and the user may communicate with one another. However, manual wardrobes are simply a chunk of furniture that only provides one service – space for storing – the interaction is an interaction from the user to the wardrobe. As a result, it cannot reply to any variety of input from the user, nor can the user create any inputs since no interface exists. As IoT centres on machine-to-machine communication, the user is capable of monitoring numerous embedded sensors and control actuators remotely in many industries and applications.

1.2 Problem Statement

The project is proposed to beat a variety of problems that consumers face throughout their daily lives where they're having a tough time finishing daily tasks. This project ensures that usage of 4th IR Technology is implemented among consumers to ease their way of life.

1. Users soak up plenty of consideration into buying the smart wardrobe as the pricing is considered high on account of the system being an all-in-one product but also being cost, time and energy effective in the aspect of long run usage. However, low-cost solutions of a smart wardrobe are hardly available within the market although the concept has been around for a few years.
2. Either male or female of all age groups are struggling with choosing the proper apparel to seem more presentable to impress their colleagues, superiors, customers, family, and friends. However, choosing the proper garment for the correct occasion might be frustrating and time-consuming.
3. Users, especially workers with a tight schedule tend to leave their laundry management unattended. They often find themselves recycling worn clothes due to their busy working schedule where the users hardly consider clothing care.

1.3 Proposed Solution

The smart wardrobe allows users to save time and approach towards a better lifestyle in organizing and managing their clothes. The device also leads to a cost-saving option as the system is equipped with various combined functionalities rather than users having to buy different appliances for the same separate functions. Incorporating smartness into a technologically supported wardrobe generates more user satisfaction by reducing the amount of effort that would otherwise be expected from the user in terms of input.

1. The purpose of the smart wardrobe helps in organizing and managing the kept garments by combining devices with laundry functions such as steaming, deodorizing, keeping track, refreshing, and sanitizing the clothes.
2. With the invention of the smart system, its functions can assist the users in preparing their clothing in advance particularly when they are in a rush with only an app that lets the user operate or monitor precious garments from anywhere, anytime.
3. To relate this project with the pandemic, a function where the device eliminates viruses such as influenza and coronavirus, reduces allergens and bacteria are included. It easily sanitizes fabrics and items that are difficult or impossible to wash before having to mix up with other garments. With a built-in steam function, it keeps the garments' creases looking crisp while reducing general wrinkling with only little effort. The smart wardrobe can save consumers' time and money when they incorporate it into their daily routines.

1.4 Objective

In this project, our goal is to place a group of technologies into a system that would aid the user in managing their garments. This is to make it easier for users to manage their lives. Below are the lists of objectives that will be achieved in this project:

1. To use the most up-to-date technology categorized under the 4th IR technology. Said technology has a wide range of applications. As for this project, we chose IoT, cloud computing, AI, and mobile technology to collaborate on. An IoT-based system would make it possible for users to have information and control over their wardrobe wherever they were. Users may access data from anywhere and at any time with cloud computing systems, and they can utilize the storage cloud to securely store vast amounts of data using these systems.
2. Proposed project provides preference to the user to manage and store clothes according to cloud-based saved events. A smart system is an approach to taking care of smart garments and storage management. This project is feasible since there are numerous sources of information and technologies available to aid in its completion.

PROJECT PLAN

2.1 Selection of 4th IR Technologies

Internet of Things (IoT)

Technology has made user's day-to-day life more convenient through smart systems integrating the Internet of Things (IoT). IoT could be a subset of ubiquitous computing that aids in the identification and site of objects in real-world settings. With the employment of sensors and actuators, a smart system may collect and evaluate data to form a choice. Sensors and actuators assist a smart system in monitoring the environment, gathering data automatically, and making appropriate modifications to the environment. Typically, such systems minimize the displeasure of users that are brought through manual systems.

An enormous number of individuals have a high enough economic standard to possess an excessive amount of clothing, shoes, and accessories aside from their fundamental needs. Managing closets has thus become a burden for fashionable individuals who are always in a hurry in today's competitive society. Most users maintain their wardrobes manually nowadays, and as a result, they often end up recycling their clothes, leaving a major amount of their garments unused. Considering that, researchers are working hard to integrate IoT into a spread of systems in a user's daily life, including smart closets, to bring more user satisfaction by reducing the workload of the users.

Considering the trouble of users managing clothes, an automatic smart wardrobe using digital image processing and RFID tag scanners that helps the users to work out the list of all their wearables, materials, suggestions of weather and occasion-based outfits is proposed.

Cloud computing

In recent years, research on the wardrobe intelligence algorithm has tended to combine with current popular technology such as machine learning, cloud computing, big data, and so on. They usually extract data at the front-end client, then use computing and storage resources to perform data mining and analysis in the back-end cloud, finally returning learning results or recommended information to the mobile phone, tablet, or another intelligent terminal to improve the user's experience.

In addition, some studies attempted to merge attires into ordinary social contact. Data can be extracted in three ways: manually by the user, intelligent identification, sensor collection, and embedded chip. These data should be closed and confidential, and they will form small-scale data when the number of users reaches a particular level. The effects of match pictures in the system are automatically generated from real photos captured by the user, users can not only easily choose their own clothes to preview the match effect immediately but also share their preferred match on the cloud wardrobe for other users to browse, grade, and comment on.

In terms of smart wardrobes, the system will recommend the best match based on the events to attend, real-time weather, physical information, popular dressing skills in cloud wardrobes, and so forth. A reliable data synchronization mechanism that allows users to switch devices and synchronize cloud data from anywhere at any time is also developed.

Artificial Intelligence

With a classy AI feature, the smart wardrobe cleans clothes quickly and effectively. The AI pattern, particularly, personalizes the control by memorizing the user's habits and displaying the foremost often used courses and settings. When a cleaning cycle is completed, it offers the foremost appropriate drying courses. Users can enjoy faster drying using AI dry technology with a humidity sensor. It recognizes what quantity the garments have dried by continuously sensing the humidity of the clothes and intelligently adjusts the drying time accordingly. As a result, the laundry is often thoroughly dried within the shortest time.

It keeps within clean and hygienic conditions to retain the best performance. The clothes inside are sanitized and deodorized using a self-cleaning technology. There is no need for harsh or a costly detergent as it cleans by employing a combination of warmth, air, and steam, and notifies the user when it needs cleaning. A deodorizing filter collects and eliminates door-producing gases emitted by clothing, preventing them from causing an unpleasant odour and secondary contamination. Sweat, cigarettes, roasting meat, and clean-up aromas are all eliminated. The mechanism blows powerful air jets upwards and downwards. It loosens and eliminates entrenched dust from clothing, even deep inside in an exceedingly quick and quiet manner. This function generates far less vibration and noise.

In addition, the smart wardrobe also irons out nagging problems like creases. The wrinkle care uses a mixture of steam and air to remove creases in clothing, allowing it to be worn in minutes. The system is supplied with smart technology, providing the perfect temperature and steam combination for complete garment protection and worry-free ironing. This easy-to-use iron has no settings and provides risk-free ironing results on all ironable fabrics, from tough materials to delicate garments. The smart protection feature produces excellent ironing results with absolute ease.

Mobile Technology

The mobile application is a prominent feature of the smart wardrobe that enables closet organization and management. It has an easy-to-use format where users can edit categories and subcategories allowing users to organize their closet according to their preference. The ease of the photo editing section allows users to input a clothing item within a matter of minutes using the tools provided for both precision and speed. One of the application features includes users being able to take multiple pictures of one clothing item, permitting multiple viewpoints of a piece of clothing.

Not only that, users can mix and match their clothing pieces for particular events and even be provided suggestions for the perfect outfit. The application is very thorough and enables users to enter a lot of useful information regarding owned garments such as the clothing material, size, filters, combination of user preferences, and suitable occasions. Moreover, the application also performs monitoring of specific functions as mentioned which includes drying, refreshing, sanitizing, steaming, and deodorizing functions within the smart wardrobe where the user can adjust the settings. Users can customize the functions according to their needs or simply choose an automated combination of functions for opting for a more time-effective option.

2.2 Potential clients

Smart wardrobe targets potential clients mainly busy entrepreneurs and those working with a tight schedule. In this age of advancement, consumers tend to demand the most up-to-date technologies, especially those that provide an easy and improved way of living. It is critical to offer a modern and convenient solution to satisfy these consumers in a way that living lavishly is preferred with the aid of advanced technologies. To be precise, working women or university students are frequently connected to this statement. This gadget will allow them to complete their laundry tasks at home by simply using a mobile application. This will make it easier for them to make garment preparations and management even on occupied routines. It helps the targeted clients stay organized and save their time in the long run by assisting them with planning and executing specific functions. This initiative aims to provide innovative technologies and modern household equipment to targeted consumers, especially at a time when hygiene is a top priority for many, even to the extent of worn clothes.

Furthermore, other potential clients include electronic companies. An electronic company is also considered a major target as it helps to grow the product in much better ways. It usually happens when entrepreneurs sell their business ideas in order to obtain funds to expand their business. The research component of the product preparation process might be eye-opening in terms of the practicality of said idea. Electronic companies are able to provide aid in actualizing this project and its potential into context where they provide specifics that are needed to take it from concept to reality. A consideration where this project idea does not have as much potential as imagined or that it will cost more than expected, the process of electronic companies developing this product assists in reaching that conclusion. At the same time, established electronic companies get their own spot in the market and are able to easily reach a variety of consumers to buy their product's brand as they have been in the industry over a period of time resulting in obtaining higher sales due to the company making the products seem more trustworthy.

ARCHITECTURE PLANNING AND DESIGNING

3.1 Planning and Designing

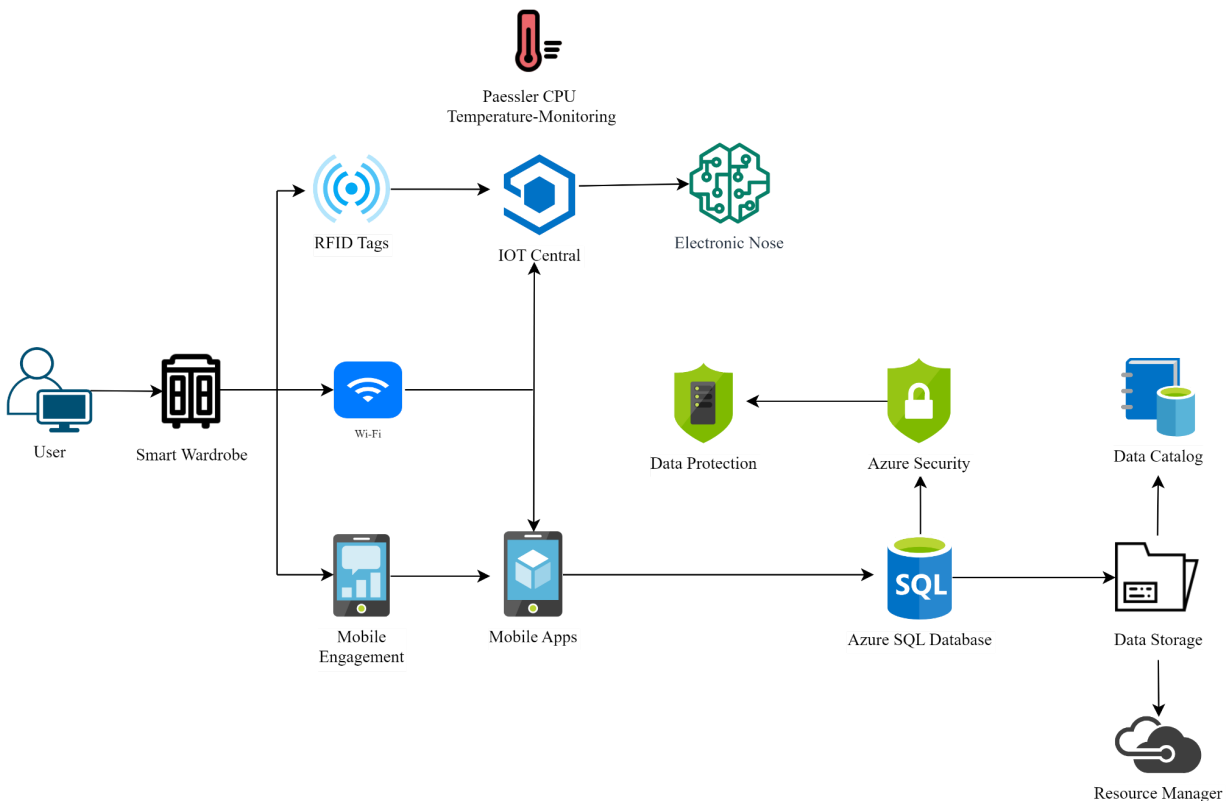


Figure 3.1 Cloud Computing Architecture for Smart Wardrobe

The project will be made up of four basic parts: a user terminal (phone, computer, or tablet), an RFID reader, Paessler CPU Temperature-Monitoring, electronic nose, and Microsoft Azure.

It consists of front-end and back-end development. When registering for the first time, the user must allow the RFID reader to read the tag, after which a push notification will appear on the user's mobile phone application. The user will need to enter further information about the clothing, including the type and name. Users also needed to snap the photo of the clothes during the registration. The system will detect information on the colour. An RFID tag is connected to

every item of clothing in the closet. The RFID reader will monitor the clothing as they are put in and taken out of the closet. Thus, the information will be sent to the phone application. The data will be sent to an Azure SQL database when it has been processed. Once the wardrobe data is synced with the universal app, the app will show users which clothes they wear the most and least worn clothes. The temperature will be detected using Paessler CPU Thermal software. This will be used to choose a proper outfit for the day.

Other than that, with AI, when a user returns clothes to the wardrobe, the electronic nose is activated. It must be positioned in a position that will allow it full access to the freshly returned fabric since it is dependent on scents/aromas that originate from the clothes. The hanger with the returned cloth must be placed at a certain spot on the rail above which the eNose is fitted and its pump is in excellent working order. When the eNose detects the presence of cloth, it will sniff for any scents or aromas to deodorize and clean it. It will keep clothes fresh by deodorizing inside the cabinet. It will filter and remove odour-causing and stop them from creating an unpleasant smell. It also helps with drying and sanitizing the clothes. After all, this smart wardrobe stops users from spending hours finding their clothes and outfits, a library is provided in the application through the smartphone, so the user can pick the outfits that they prefer from the library and it will automatically be steamed and ready to use.

1. Front-end development - The mobile application will consist of visual elements that users will be able to interact with such as the 'Setup', 'Erase', 'Out', and 'In' buttons. It also provides images of clothing items that the user has registered in the application.
2. Back-end development - For the server side of the smart wardrobe mobile application, this project will use an Azure SQL database to store the data regarding the clothing items registered. The type, name, and picture of the clothing item will be stored here.

3. RFID (Radio Frequency Identification) System - This system will identify individual clothes. RFID tags can only be read from a certain distance. The reader and tags must be installed in such a way that all the clothes within the closet are within reading range. Clothing that isn't in the wardrobe must also be out of the reading range.
4. Middleware application - This application has multiple roles. It performs data processing, receives the unique RFID tag number from the RFID system, and extracts data related to the tag ID from the database. It also receives data and performs the necessary processing. Finally, it controls the overall working of the system
5. Azure Functions - This cloud is an on-demand cloud solution that offers all the constantly updated infrastructure and resources required to execute your apps. It manages to store data about every single detail of the clothes.
6. Paessler CPU Temperature-Monitoring - This device will be used for detecting the temperature for the smart wardrobe to choose a proper outfit for you.
7. Electronic nose - This will be used for sniffing and recognizing aromas and odours emerging from the indicated clothes with an electronic nose. Its setup must provide it with complete access to the fabric that has just been returned. Once the system has detected the presence of cloth, the eNose then sniffs it for any smells or odours.

Users will buy new clothes over time, or there will be clothes they do not want to wear because they are damaged or do not fit. We must plan for the capture of the contaminated clothing. A user picks the 'Setup' option from the main menu on the screen to add a new clothing item. This displays two further choices, one of which allows the user to add a new garment and the other of

which allows the user to delete a garment that is no longer accessible. The system then searches the database for RFID tags that do not have the required information and shows the fields that are lacking on the screen. When removing a cloth, the user scrolls to the desired clothing to verify whether it should be erased.

3.2 Flowchart System

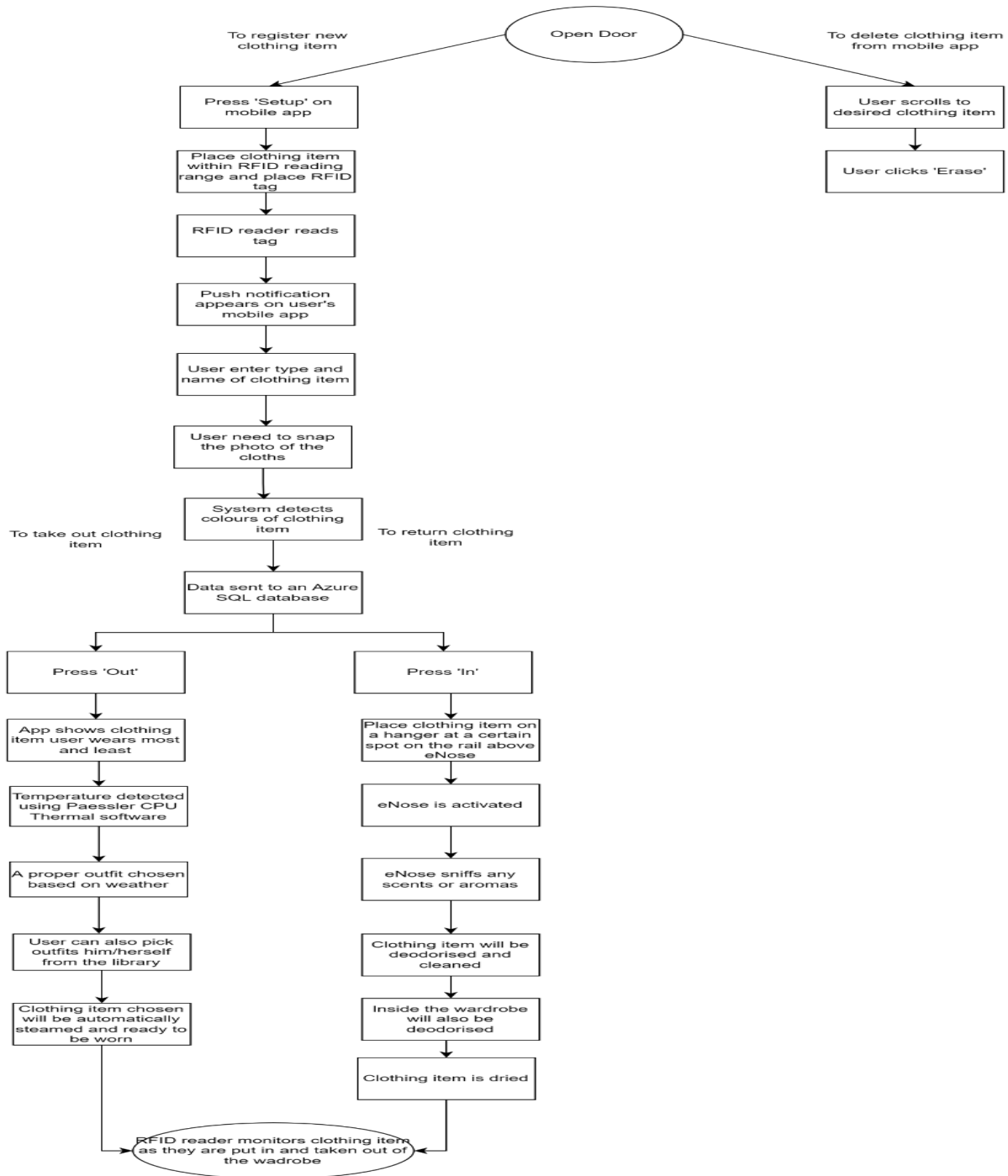


Figure 3.2 Flowchart Consist of Instruction to Use The Smart Wardrobe

CONCLUSION

4.1 Benefits

With the pandemic disrupting the world, it's more important than ever to ensure that the objects around us are properly sanitized and maintained as clean as possible to fight off Covid-19. There is currently a greater need for cleanliness solutions, particularly for items that people constantly touch and use. Once the clothes are folded or stored in the closet, it is exposed to the air and any small airborne contaminants that may be present.

With this in mind, our smart wardrobe has introduced its clever answer where a smart system equipped with cutting-edge technology that successfully sanitizes materials, steams them, and keeps them ready to wear the next day. This smart wardrobe employs a steam system to disinfect the textiles by removing germs and loosening dust, a deodorizing filter to eliminate smells, and a heat pump to gently dry the clothing at a low temperature, so you don't have to worry about heat damage or shrinkage.

Besides, it also helps with tracking the number of the clothes that have been worn so the user can track which clothes they have not worn yet.

The user also can set up the clothes they want to use for a certain event and customize their outfits through their smartphone.

Furthermore, the system learns to select clothing based on mood, weather, time, and other factors. Hence, rather than wasting hours upon hours picking an outfit, the RFID-based system might advise what should be worn and the exact location of the things selected. The device features sensors that can anticipate the weather and then choose the best clothing based on the forecast.

4.2 Limitations

1. The limitation of this smart wardrobe is it still needs to have its maintenance and cleaning.
2. Besides, eNose is also one of the most expensive items to be placed inside the smart wardrobe system, thus the overall price of the smart wardrobe will be pricey.
3. Instead of its luxurious looks and system, the other limitation is it is heavy and huge which needs more manpower to move it around.
4. The smart wardrobe is unable to work without an internet connection.

4.3 Summary of Proposed System

The project's goal is to put together a set of technologies into a system that will aid the user in managing their clothes. The smart wardrobe can be used by the customer in various ways depending on their liking. The Wi-Fi connection and the app on the user's smartphones are dealt via the smart control feature. Users may change their settings and pick what clothing they wish to wear the next day or at any moment by using the app. Users may also use their smartphone to handle anything from clothing, time, and days to wear outfits from the library, heating temperature, and more. Everything is right at the consumer's fingertips.