Revolutionary Approach for Smart Washing Machine using Machine Learning & Artificial Intelligence

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Abstract- Smart homes have started reshaping the place where people live and a smart washing machine is an addition to it. The fast pace of our life has led to automation of many of the household items. The next step in evolution after automation is smart and sustainable machines. In this paper we are introducing a ground-breaking concept of smart washing machine which analyzes the clothes and based on their specifications chooses the most appropriate type of wash for the clothes. This will reduce the fading of the clothes and can reduce the usage of soap than the conventional washing machine. It uses Artificial Intelligence and Machine Learning for enhancing the use of washing clothes more efficiently and effectively. By using less water than the conventional washing machine, this technology is paving a way to sustainability. Cameras, RFID patches, RFID reader are some of the technologies used for analyzing the material of the cloth. Using AI and ML we can choose the suitable type of wash for the clothes. This will increase the life span of clothes by mixing the right amount of detergent which in turn will reduce the water used. This will lead to a smart and sustainable lifestyle.

Index Terms- Artificial Intelligence, Machine Learning, RFID, Smart washing machine, Sustainability

I. INTRODUCTION

Artificial Intelligence and Machine Learning are the new emerging trend in the home appliance industry. Homes are getting integrated with technology with almost everything in the house which is taking us to the future. Consumers are becoming more tech-savvy and their expectation rises with the advancement in technology [1].

The current washing machines have different washing method for textiles, which will not allow clothes to get knotted, disarranged or entangled by intensive agitating cycles [2]. Damping the vibrations of the drum of the washing machine is one of the latest designs implemented in the current washing machine products [4]. [10] speaks about how only three wires are required for communicating inside the machine. The network can be used for communicating via home network to manage peak energy usage and add a new level of troubleshooting and field upgrades. A smart washing machine is a device which learns from the previous data and improves the quality of the next wash [6]. Nowadays the conventional washing machine has changed to a machine that can not only wash but also dry the clothes.

We are proposing a concept project where in, we are developing a smart washing machine that interacts with you and is more sustainable. The usual problem with traditional washing machines is that different materials of clothes need different types of wash. Using the same type of wash for different cloth materials damage the clothes and its durability decreases. The amount of soap that is used to wash also

plays an important role in durability of the clothes [7]. Conventional washing machines tend to use a lot of water than required while washing the clothes.

The smart washing machine analyses these factors and accordingly washes the clothes without damaging them and by using less water. It analyses the data of the clothes and accordingly chooses the appropriate type of wash. This solves most of the above-mentioned problems faced in a conventional washing machine.

II. CURRENT SCENARIO AND IT'S PROBLEMS

A. Present Scenario

In the recent times, textile industries have evolved to smart clothing. These involve smart clothes which has various sensors in the fabric which gives various inputs such inbuilt music players, health monitoring sensors, etc. [9]. Many of the textile manufacturing companies are adapting RFID technology by embedding RFID tag in their products to track them from the warehouse to the customers [8]. The RFID tag contains all the details about the product so it is easier to keep track of the products. [3] compares on how much water is being used and how much water is actually required for washing.

[5] talks on how the data can be gathered from the washing machine. It also talks about bidirectional data flow between washing machine and cloud for analytical purpose. A survey conducted by IBM found that 99.9% of the customers use only 3 of the many wash modes. This made the washing machine manufacturers to cut down the uses of other wash modes which reduced their engineering and R&D costs [5].

B. Research Gap

Washing machines have not evolved parallelly with other home appliances in the area of cloud technology. Other home appliances such as television has moved from CRT TV's to LED to Smart TV's, Refrigerators have moved to smart technology fridges and many more. There are lot of research papers on the technical aspects such as reducing the sound and damping of the washing machine. Most of the research papers are based on the automatic washing machines. This paper aims to bring washing machine into the smart home sector.

C. Problem statement

To develop a smart washing machine, which analyzes the data about the clothes, then selects the most appropriate method and uses minimum amount of water for the wash. It also uses the appropriate amount of soap, so that the color of the cloth does not fade faster.

D. Objectives

This paper is intended to integrate AI and ML into washing machine so that it identifies the type of cloth using RFID reader and based on that chooses the appropriate mode of washing. Based on the selected mode, appropriate amount of soap and water is to be added with the right temperature.

III. PROPOSED MODEL

A. Components Used

A.1. RFID tag

It has all the details about the clothes such as the color, material of the cloth, the temperature at which it should be washed and the appropriate type of wash.

A.2. RFID Scanner

The RFID scanner scans the RFID tag which is embedded into all the clothes. Then it sends the information to the microprocessor.

A.3. Microprocessor

The microprocessor collects all the data and sends it to the cloud. Based on the information it gets from the cloud it starts with the washing process accordingly. It controls all the sensors in the smart washing machine.

A.4. Sensors

A PH sensor is also fit to identify the PH level of the water entering the washing machine.
Water level sensor- To sense the amount of water to be filled.
Detergent level sensor- A sensor to measure the amount of soap present and the quantity that is dispersed into the water for washing.

Fig.1.1 shows the components and flow of data from scanning clothes till washing of clothes in the smart washing machine.
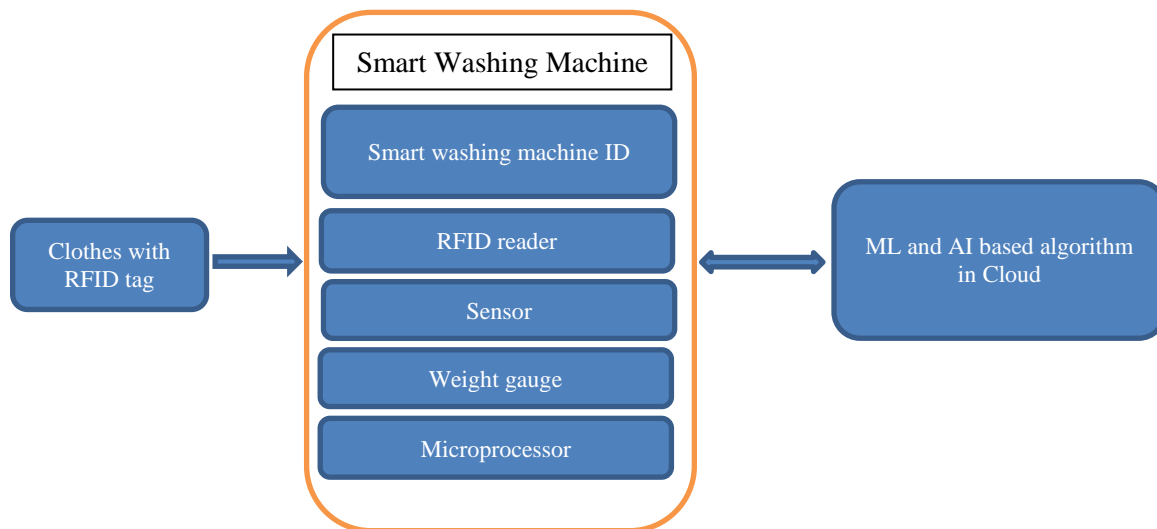

Fig.1.1: Architecture of Smart Washing Machine

B. Working process

The smart washing machine is first connected to the home WIFI network. Then the clothes are put in the smart washing machine drum where the RFID tags embedded on the clothes are scanned by the RFID scanner. This gives the details of the cloth such as the color, material type, the temperature at which it should be washed, type of wash and weight, etc. The microprocessor takes the data of clothes from the RFID scanner and send it to the cloud. The cloud which has machine learning and artificial intelligence algorithms process the data and sends the appropriate temperature, the amount of detergent soap, the amount of water required and best appropriate mode for the wash. This information is then sent to the microprocessor, based on that it chooses the amount of detergent, water and the temperature of the water and then adds it to the drum. Based on the type of wash, the microprocessor chooses starts the process of heating the water and soaking the clothes for certain period. If there are 2 or more clothes which have to be washed differently, a notification is sent to the mobile saying that there is a contradiction. So, the user

can remove the cloth, or the user can ignore the message, which the washing machine automatically chooses the best type of wash for it. After taking all these into considerations, it starts the wash. Once it has finished washing, it will send a notification to the user that the wash is complete. The smart washing machine then takes a feedback from the user and then sends the results to the cloud. These results will be analyzed by the AI and ML which will use it for future reference. Fig.1.2 shows the working processes of the washing machine.
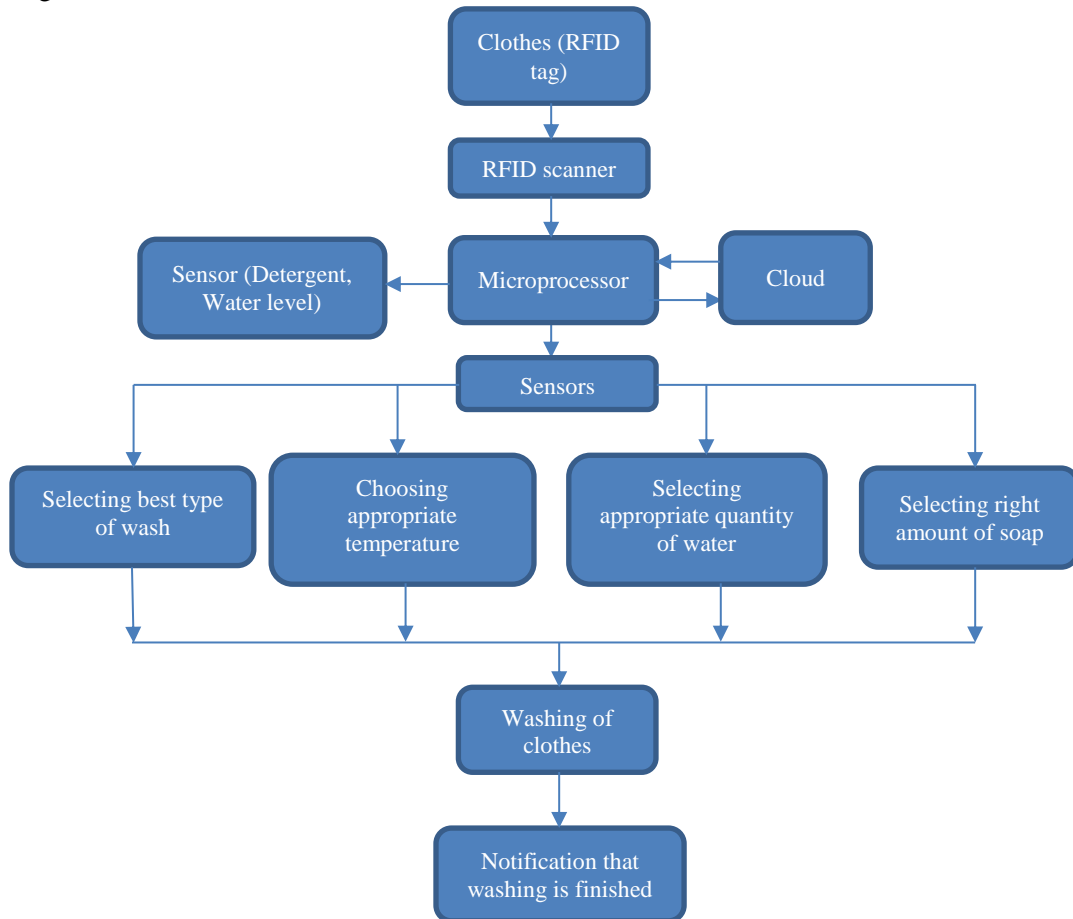
Fig.1.2: Flowchart of working procedure

B.1. Working of detergent soap sensing unit

The microprocessor checks the quantity of the detergent soap left in its storage. If it is less, it sends a notification that the detergent level is less so that the user can refill it. After this the microprocessor calculates the amount of soap and water required for the wash. Fig.1.3 shows the working of the detergent soap storage in the smart washing machine.

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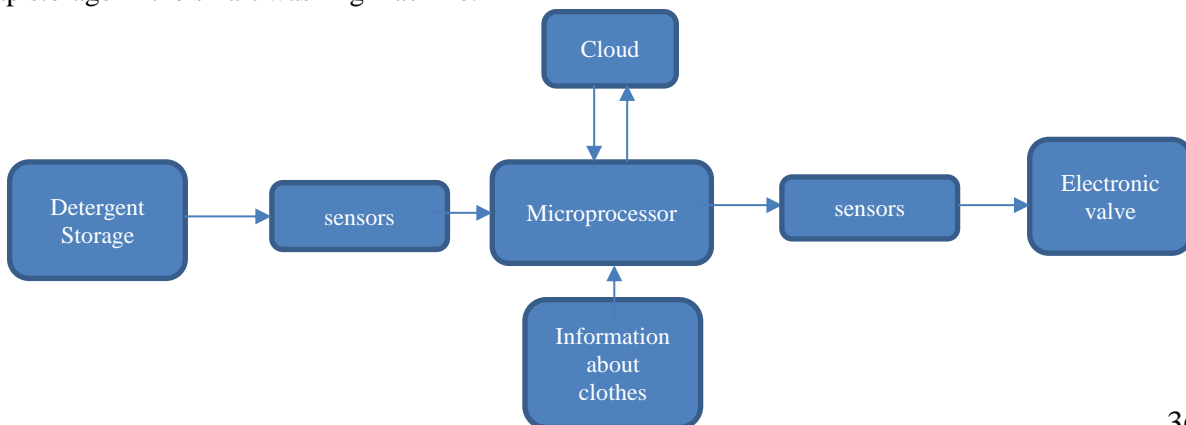
Fig.1.3: Working of the detergent soap sensing unit

IV. EXAMPLE

A. Conventional Washing Machine

Let's consider a situation where Ms. Padveeni is using an Automatic Washing Machine. She puts different types of clothes (4 cotton, 1 wool and 1 silk) for wash in the washing machine. She sets the temperature to 50 degree Celsius. She puts an approximate level of detergent soap in the machine. She set the mode in Cotton mode because majority of the cloth put for wash were cotton clothes. Then started the wash. After the wash when she removed the clothes, the cotton clothes were washed properly, but she was not happy with the condition of the wool and silk clothes. This is because, wool cloth should have been washed in a different temperature than cotton or silk and needs special care while washing. The silk cloth requires very less amount of detergent soap than the other type of clothes.

B. Proposed model (Smart Washing Machine)

Let's consider a situation where Ms. Padveeni is using the Smart Washing Machine. She puts different types of clothes (4 cotton, 1 wool and 1 silk) for wash in the washing machine. The RFID scanner reads the RFID tag of all the clothes put in the washing machine. It sends a notification that there are silk and wool clothes which cannot be washed with the same setting as cotton clothes. She ignores the warning and presses the start button. The Smart Washing Machine then finds the best wash for this set of clothes i.e. it sets the temperature between 35- 40 degree Celsius.

It uses the approximate amount of detergent soap and correct level of water required for the wash. This pattern of clothes and the appropriate type of wash gets stored in the cloud, so that the cloud can use the same data for the next wash for the same type of pattern. After the wash, the Smart Washing Machine collects the satisfaction level of the user and if there is any problem with clothes. This data gets stored in the cloud. So, when the same pattern comes for wash next time, ML and AI can analyze the satisfaction level and the type of wash used and corelate it. So, this can make the next wash more efficient and productive.

V. FUTURE WORK

This proposed model can be used a base model for finding out the actual water requirement used by the washing machine and also the amount of detergent soap which will be used. This can help the user quantify the amount of detergent soap to be purchased. This can be used by marketers for finding out the amount of detergent soaps required by every households and based on the consumption pattern they can maintain the stock accordingly.

VI. CONCLUSION

This novel concept which is an integration of AI and cloud-based computing has a bright future and is bound to branch out into various other dimensions of the home appliances especially with smart homes which are becoming more common. The smart washing machine will enable its users for a smarter and more sustainable use of water and detergent soap. As this washing machine programs and reprograms itself based on Machine Learning and Artificial Intelligence algorithms in the cloud, preprogramming of the washing machine is not required. This reduces the manufacturing and R&D costs for the manufacturers. This Smart washing machine will open new opportunities and take smart homes appliances to a new revolutionary level.

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