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# SMART CARE-INNOVATION IN WASHING MACHINES USING IoT

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***Abstract-Product maintenance and support services provided to customers for a product plays a major role in the success of any product. The goal of any company is to provide best customer service. Setting up connected devices provides better service in many situations. To enhance customer care services in washing machines, this paper focuses on smart care in washing machines using internet of things. Generally customer's appliances are provided with the service only when they intimate it. Innovations in smart washing machines involve self-sensing the part of the machine that has become faulty and most importantly the machine intimates it immediately to the customer service centre and to the user about the faults encountered through text messages without any human intervention. When a washing machine is encountered with a fault, it will automatically sense it using sensors and will immediately send a text message to the nearest customer care service centre of the concerned brand. The washing machines also make the user aware of the fault by a text message to the customer's smart phone. The message sent to the customer service centre involves the fault encountered and sensed by the machine, product specifications, date of purchase and the warranty period available, as these would help in analysing the current state of the machine. Based upon the information, timely and best customer service can be provided to customers.***

***Keywords-Twilio, Public Switched Telephone Network, IP Telephony, fault codes, Internet of Things (IoT)***

## 1. INTRODUCTION

The Internet of Things is a novel paradigm, in which millions of devices that are expected to be connected to each other and to the internet. IoT can support a wide range of applications in different domains, such as health care, smart cities, pollution monitoring, transportation and logistics, factory process optimisation, home safety and security [1], [2].IOT also plays vital role in business. Customer satisfaction service is an important strategy to evolve as best competitor in business. A recent survey tells that nearly 60% of consumers want their smart home devices today. They don't want to have to prompt their devices to complete an action [3]. They need a radical evolution where interconnected objects collect information from environment and interact with the physical world, but also use existing Internet standards to provide services for information transfer, analytics, applications, and communications [4]. However, if the devices are

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unable to automate themselves, voice-controlled settings and the ability to give instructions via text message are preferred things from a consumer point of view. Customer's interests in smart appliances revealed that there is a clear tendency in all countries regarding consumer acceptance. In general the acceptance level of the people towards smart appliances is very high and consumers have a rather positive approach towards appliances connected to Internet.

This paper presents smart customer care service in washing machine. In section 2, various smart devices in smart environments are discussed based on literature survey. The proposed work which deals about smart care in washing machines using IoT is the subject of section 3.Section 4 explains about construction and working of proposed system. Conclusion is given in section 5.

## 2. RELATED WORKS

Smart devices of today's world can make our life more comfortable. Sensor networks in various environments play crucial role in IOT in several aspects like room heating based on weather ,room lighting according to time of the day, energy saving by automatically switching off the electrical equipments when not needed[1].

The list also includes refrigerators with the water and ice dispenser for continuous filtered water and crushed or cubed ice at the touch of a button ensuring the purity and freshness of the water and the ice, Dishwashers with Storm Wash that gives great results while washing dirtiest pots and pans, Cooker hob with Multi-use zones that can accommodate several dishes at once , Ovens with dual cook technology provides temperature-controlled sections to cook any two dishes at the same time saving half an energy.

Hence people all around the world hope that such solutions will make their life more comfortable by less house-work, saving their time and therefore hence have a positive attitude to adopt these technologies.

## 3. SMART CARE

The smart operation acceptance concerning the washing machine was very high in all countries (range between 88 to 97%). We already have timers in washing machines, if the timer counts down to "0", it will be notified by an alarm or by a text message. People claimed, they would use the smart mode up to 90 or 100% of the time. So, we still have need for innovation in washing machines.

In this paper, a novel idea is proposed to provide fast and excellent customer care services in washing machines. If there is any fault encountered in smart washing machine, then it self senses parts of machine and informs to customer care service and user about fault through text message without any human intervention. The message sent to customer care service includes details like type of fault, product specifications, date of purchase and the warranty period.

This information can be helpful to analyze the current state of machine. It can be also used to provide fast and accurate repair service. Customer can have brief outline of the fault, even before the service team intimates the customer with the reason for the faultiness and this becomes possible by means of IoT.

## 4. CONSTRUCTION AND WORKING

The hardware components required for basic working model to improve customer care service are explained here.

### 4.1. Architecture and design

The hardware components needed are

- Electric Imp
- ADXL335 analog 3.5V ±3g accelerometer

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- April development board
- Printed Circuit Board of the washing machine
- Sensors that are used for normal functioning of the washing machines
- Solid wires

### 4.1.1. Electric imp

This paper considers using Electric Imp microcontroller. The Electric Imp is a microcontroller in the form factor of an SD card with a 32bit Cortex M3 processor. The most interesting about the Electric Imp is that it also includes an 802.11b/g/n chip, making it one of the smallest Wi-Fi enabled microcontrollers. April development Board, a breakout board from the Electric Imp team is also used which breaks out the pins on the imp and provides a mini USB connection for power to the microcontroller.

### 4.1.2. Accelerometer

For the accelerometer, the component that measures the vibration of the washing machine/dryer to detect whether the washing machine is on or not, the ADXL335, a 3.3V analog accelerometer sensitive to ±3g is chosen.

## 4.2 Construction and assembling the hardware

Configuring the Electric Imp with Wi-Fi credentials is done through a clever process called Blink Up. The Imp itself contains a phototransistor, which enables us to program our Wi-Fi credentials optically, via an app on Android or iOS device. Once the app is installed and configured, the display on phone strobes in a pattern recognizes the Imp, which programs the Wi-Fi credentials into the Imp.

When writing software for the Electric Imp, we need to write two programs. The first program, called the "Device", runs on the Electric Imp hardware. The second program, called the "Agent", runs on the Electric Imp cloud. The Agent has the ability to send and receive HTTP traffic, making it a perfect candidate for the Twilio API, a RESTful API that allows us to send SMS messages [5].The programmed electric imp sends information from electric imp cloud and then connected with twilio interface.Once Wi-Fi credentials onto the Imp are programmed, it will automatically connect to the Electric Imp cloud service.

From there, we will be able to login to the web based IDE and program the imp via our web browser. The codes here involve the numbers to send the error code and the fault definition of corresponding error codes (for easy understandability by the user when received the error messages through texts).The IDE handles deploying code updates to the device, as well as any changes in the number of the customer or the nearby customer care service is made easy.

The assembly of the device is relatively straightforward. First, we need to assemble the April development board and the ADXL335 breakout board by soldering the header pins onto the breakout boards. Next, we have to solder both breakout boards into the perm-pronto board. Lastly, we have to solder in the 5 wires to enable the two components to communicate.

The above assembled hardware in the breakout board is connected to the printed circuit board of the washing machines. This assembled hardware is in turn connected to the microprocessor in the PCB resulting in an established communication. Hence the sensors soldiered to the PCB is also capable of sending and receiving messages to the Wi-Fi enabled microcontroller.

## 4.3 Working

Whenever a washing machine is encountered with a fault the sensors and switches inside the washing machine will sense and intimate to the microprocessor in the PCB Board. The microprocessor is programmed with the fault codes

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such that it detects the type of the error and intimates it in the visual display as error codes. The idea here is not to send the error codes which often occur to the customer care but the faults in the washing machine that makes the microprocessor halt its functions.

The microcontroller of the PCB is programmed in such a way that it keeps track of the continuous difference in the range values of the sensors and the switches and maintains a record. If a washing machine is found with the serious fault such that the microcontroller can work no more for giving instructions (when the machine basically fails), the microcontroller with the Wi-Fi will transmit the error code over the internet to the electric imp cloud service. The electric imp cloud service will in turn send message over the Wi-Fi to the twilio interface.

The twilio interface will text the fault encountered to the numbers in the twilio array of the programs written in the electric imp [6].This happens by means of IP Telephony. Twilio interface uses Amazon web services for creating a telephony infrastructure and establishes connections between the http and the Public Switched Telephone Network. Hence the digital signals received as packets over the Wi-Fi consisting of the error code can now be transmitted over the circuit switched telephone network. Hence the customer care and the customer receives the text messages. The message sending and receiving is depicted in Fig 1.

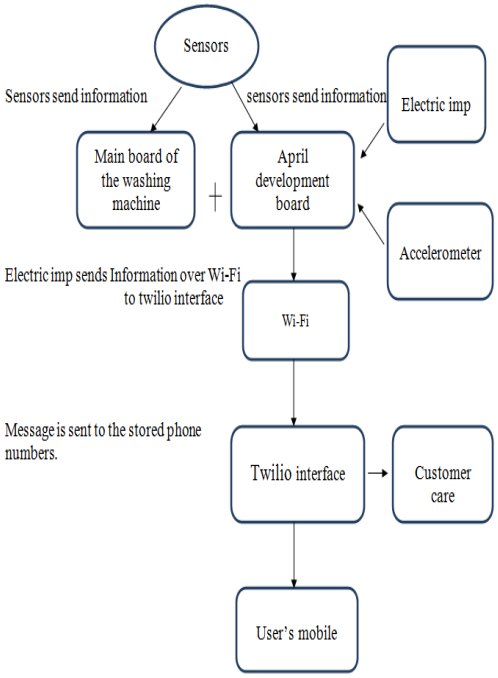


**Fig 1:Information transfer from smart washing machine to customer care and user**

## 5. CONCLUSION

Internet of things (IoT) makes the smart objects to communicate each other.This paper provides the base idea for improving customer care services and also in improving the reputation of the product. The idea provided is cost effective since it takes only 0.20$ to send a text message to the customer care and the customer service center using twilio interface. Further this idea can be applied to washing machines of any company and it can also be used to analyse quality of products manufactured by a company.

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## 6. REFERENCES

[1] L. Atzori, A. Iera, and G. Morabito, "The internet of things: A survey,"Comput. Netw., vol. 54, no. 15, pp. 2787–2805, Oct. 2010.

[2] O. Vermesan, P. Friess, P. Guillemin, S. Gusmeroli, H. Sundmaeker,A. Bassi, I. S. Jubert, M. Mazura, M. Harrison, M. Eisenhauer et al.,"Internet of things strategic research roadmap," Internet of Things-Global Technological and Societal Trends, pp. 9–52, 2011.

[3] Smart Home Report 2015,<http://www. icontrol.com/wp-content/uploads/ 2015/ 06/ Smart_Home _Report _2015.pdf >.

[4] Jayavardhana Gubbia, Rajkumar Buyyab, Slaven Marusic,Marimuthu Palaniswami "Internet of Things (IoT): A vision, architectural elements, and future directions" Future Generation Computer Systems29-1645–1660,2013.

[5] A Guide To using IMU (Accelerometer and Gyroscope Devices) in Embedded Applications, <http://www.starlino.com /imu _guide.html>.

[6] <https://www.twilio.com>