Intelligent System For The Sterilization Of Doors

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Abstract: Currently, people in the world are exposed to thousands of bacteria and risks of being exposed to communicable diseases with or without their knowledge. Until the cure for such illness can be found, then the only way out is finding an effective preventive measure to reduce such cases. When especially you think of cases such as toilet doorknobs and the number of people who do not wash their hands after using the facilities, then the issue becomes even more severe. These handles act as primary locations for bacteria and microbial activities.

Index Terms: IR Sensor, Sterilization, Doors, Real Time, Product Development, Test.

1 INTRODUCTION

A study done by Schaumburg et. al (2016) shows that most of those microbes have the ability to transmit diseases. The primary drive behind this project is, therefore, to support the ideology that prevention is better than cure. The concept aims at finding a solution to reducing/eliminating microorganisms from doorknobs by designing a system that self-sterilizes doorknobs every time they are used. The design is very simple since it uses infrared sensors to detect human hand temperature and once someone has released the door handle, it sterilizes after 4 seconds. A small dryer is also incorporated to ensure that the sanitizer dries as fast as possible. This idea was generated from personal inspirations of believing in cleaner environments and not having to carry sanitizers everywhere. New viruses and normal diseases like colds cost thousands of dollars to both the economy and the health care system due to employees being sick periodically (Cogen, 2008). Because self-cleanliness may not be enough, probably this idea can spark the beginning of other self-sterilizing objects (like office keyboards) which may go a long way in preventing the transmission of contagious diseases.

2 Discussion

2.1 Establishment of Objective and Criteria

As already mentioned here the idea is to make a self-sterilizing doorknob that can ensure that the highest level of cleanliness is maintained. On the broader perspective, there is a secondary aim of reducing contagious diseases. At the end of the project, the impact should be measurable, by gauging the level of germ exposure on publicly used doorknobs before the system is put in place, and after it has been installed. The expectation is that the germ count will be low once the project has been executed. Additionally, since this may look like a complicated project when read on paper, the design should make sure that the materials being used are locally available and the plan is easy to execute. This will make sure that it is cost-effective and easy to operate and maintain. In order to also ensure that the work plan is successful the execution must be time-based just in case there is a need for error correction or refinement. On the other hand, in order to ascertain that the project is goal oriented, an evaluation will be done at specified periods.

2.2 Design Synthesis

The idea at this phase is to make sure that the hardware and the software of this design combine in such a way that the main objective of sterilizing the doorknobs is achieved. The aim here is that the system will be automated based on remote sensing of the human body temperature. Infrared sensors will be installed on the door, and once a human hand touches it, it will automatically satirizes it 4 seconds after. The system will also be based on a cyber-physical environment, which means that technicians will be able to operate it remotely.

2.3 Analysis

Before the project can be successful, it is important to first understand the different variables that will be essential to its construction.

2.4 Power – the idea here is that this product will either be powered by electricity through a DC transformer or rechargeable batteries. If it is the latter, then will be a low battery-warning indicator so that the operators are aware.

2.5 Operation – firstly, there is a huge decision to make on whether the device will only be remotely controlled or also include the manual part of it. The advantage of the former is that it enables rapid automatic range configuration of the system (especially in areas with multiple self-sterilization systems). On the other hand, incorporating the manual controls makes it easy to operate when there is low power. It would be better if both of them were incorporated.

2.6 Time – the time duration that the doorknobs should sterilize after they have been used. Additionally, the process of disinfecting the knobs when they have not been utilized for a while.

2.7 Construction

It is important for the compartment of the system to be as small as possible so that the ergonomics of incorporating it in a door can be minimized. In such a case, therefore, the valve for the sterilizer, the power option, and the sensor as well will be built in a single box housing with a key and lock option. The doors will also be restructured so that they can be able to hold the sterilizer bottle and the small drier. It is ideal for the whole system to conceal the system after installation to avoid constant tampering by authorized personnel. The sensor plate will be easily removed for both maintenance purposes and replacement of batteries, just in case; it is not powered by electricity. It is important that the infrared sensors be placed directly on the top part of the doorknob for easier detection of the body temperature.

3 Testing and Evaluation

Technically, this product should be able to work when put under the toughest of conditions. Therefore, the testing phase will be done on public areas that are used frequently

and are prone to a lot of microbial activity. The ideal places are therefore public toilets and airports. Hygiene swab kits will therefore be used to check for bacteria activities before and after the device has been installed. Additionally, its functionality will also be looked at, especially the spraying and drying of the liquid sterilizer. It is important that the drying process is fast because liquids on the handle may seem gross to some people. Evaluation can then be done through looking at how effective the product is and also looking for responses from people who use different facilities on how they think the system will improve their lives. The sterilization process should be basically undetectable but efficient (In Lakkis, 2016). The lower the germ activity on those knobs the better it will be.

3.1 V-chart Design

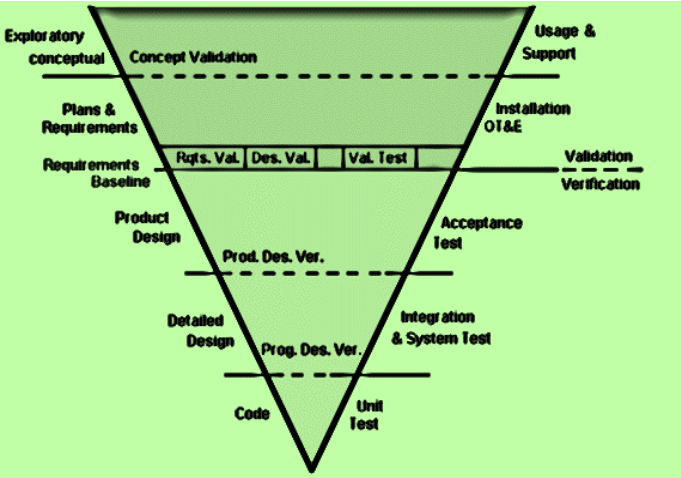

Figure 1: *V-chart for the self-sterilizing System*

3.2 Product Development

Exploratory conceptualization- it is the first step in the project development process, which is developed by the client outlining the problems that are supposed to be solved.

Plans and requirements – the idea of what the system will achieve to meet the customers needs.

Requirement baseline – the developer's considerations of the system in terms of both functional and non-functional requirements

Product design - mapping the features of the system and defining the relationship between different components. This is the part where the idea of how the infrared, door knob and sterilizer will work together as a unit is conceptualized.

Detailed design- Description of how each individual part will perform its function

Component construction (coding) – building components and coding before the test process

3.3 Testing

Unit test – ascertaining that each of the features mentioned in the detailed design section is working correctly

Integration and system test – checking whether different components have been installed in a way that they work together

Acceptance test – testing the system against the specifications to see whether all the requirements were met

Validation and verification – establishing whether the system meets the business goals

Installation – putting the system into place physically
Usage and support – maintaining the system and making sure it runs without gaps

4 Summary

From the information presented in this paper, it is clear that the idea here is useful and can be execute. It also seeks to solve a common problem in our society, therefore; people are likely to relate to it. Also, the cost of operating it is significantly low, which makes it something businesses, would consider using in their facilities. Consequently, there are no hazards associated with the device because the safety matters have been taken very seriously. Overall, the idea seems achievable.

4.1 Pictures Showing How the System Works

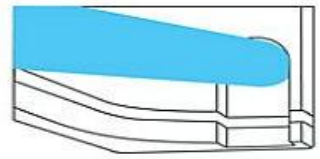

Figure 2: *infrared sensors are activated after a human hand has touched the doorknob*

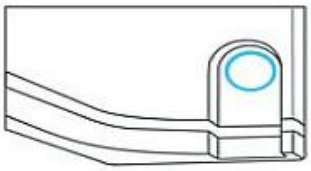

Figure 3: The timer is activated so that it can sterilize after 4 seconds

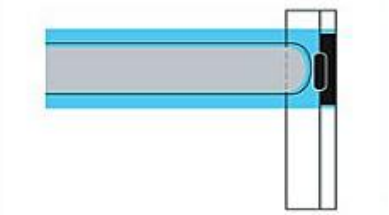

Figure 4: *Sterilization takes place*

Figure 5: *The handle is ready for use again*

Design Considerations

Economic

Firstly, the design is likely to be a bit costly in the long run due to the fact that the people responsible will have to keep on adding sanitizers every now and then. Additionally, it might also contribute to high electricity bills. On the other hand, the standards that it is being built on are high which will ensure that there are low maintenance costs Also, making the door knobs germ free will go a long way in ensuring that people are health and the economy does not slow down due to people being sick.

4.2 Environment and Sustainability

The sanitizers being used here must be registered under the National Organic program to make sure that they are not harmful to the environment. In the future, the designers will look at ways where the device can be powered through more sustainable means.

4.3 Health and Safety

Since technically, the device is aimed at reducing the germ levels on knobs, it is very safe to the human body. Since it is understood that some people might be allergic to sanitizers, then the product will use custom made ones from aloe vera gel, vodka, and tea tree essential oil. This is not only sustainable but also very useful in reducing any cases of people having contact dermatitis.

4.5 Manufacturability

As already discussed in the previous section, the idea behind the construction of the device is to make sure that most of the components are locally available. The whole design will also be easy to assemble so that when manuals are issued people can do it their self or hire a technician to do it. This will also make ensure that maintenance costs are significantly reduced.

4.6 Social and Political

This is a device that has the interest of people at heart and one, which considers their health and welfare. The expectation is that people will find it easy to associating with it and also appreciating the long-term effects that it has on the public. The first businesses to roll out this project will be expected to have close relationships with their customers since it is something that ensures that the highest level of cleanliness is maintained.

References

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