SAFE BOOTH – AN AUTOMATED DISINFECTION SYSTEM USING FAR UVC

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DOI: https://doi.org/10.54476/2773638

ABSTRACT

This paper aimed to address the current gaps of health and safety measures done by the institutions and establishments to counter Covid-19. The current system has the manual way of getting temperature of each individual; using hand sprays and washing of hands, the attendance using logbooks and biometrics are some of the fastest ways of transmitting virus that poses risks to the people. Thus, these gaps pushed the researchers to find an alternative way of carrying out things and lessen the risks. Safe Booth was developed as a platform composed of microcontrollers and electronic circuits that records the attendance, scans for temperature and disinfects the employees, students, dwellers, residents of the village, apartments, condos and etc. Likewise, it features a thermal camera, RFID / QR / for attendance, UVC disinfection, Buzzer, Web Portal that displays the profile and temperature, Real-time data monitoring via dashboard. With this, it will not eliminate the virus but at least it will help to prevent its spread. The researchers used the Agile: Scrum methodology of software engineering as a framework. Following the framework, the researchers sat down with the stakeholders and collected their concerns and listed it as user stories. The researchers then gave the user stories a schedule of activity and the corresponding module was created to create a solution to the existing problems. Along with this is the collection of resources and staffing. During the development, the team leader conducted daily standup meetings with the whole team and respondents to make sure the all the project deliverables are met and the project is at the right pace.

Keywords: Micro-controllers, Internet of Things, Ultraviolet C, Covid Response, Sensors, Wireless Technology, Web Application.

INTRODUCTION

Coronavirus disease 2019 (COVID-19) was first reported in December 2019 and then characterized as a pandemic by the World Health Organization on March 11, 2020. Despite extensive efforts to contain the spread of the disease, it has spread worldwide with over 5.3 million confirmed cases and over 340,000 confirmed deaths as of May 25, 20201. Given the rapid spread of the disease, including through asymptomatic carriers3, it is of clear importance to explore practical mitigation technologies that can inactivate the airborne virus in public locations and thus limit airborne transmission (Buonanno, M. et.al

2020) With the ongoing novel coronavirus disease 2019 (COVID-19) pandemic, the number of individuals that need to be tested for COVID-19 has been rapidly increasing. A walk-through (WT) screening center using negative pressure booths that is inspired by the biosafety cabinet has been designed and implemented in Korea for easy screening of COVID-19 and for safe and efficient consultation for patients with fever or respiratory symptoms (Kim, S. I., 2017). Body temperature is one of the most commonly used indicators of health status in humans (Fernández-Cuevas et.al.,2015). To measure temperature non-invasively infrared radiation can be used that is naturally emitted from the surface of every object (Vogel, B. et.al 2016).

Due to COVID-19 many establishments permanently stopped their operations permanently and others try to survive with the new normal. New normal is a set of rules defined by the Inter-Agency Task Force (IATF) in order for the community to function with the existence of covid-19 in which social and economic life can function, a continued whole-of-government and whole-of-society approach. This means that we have to work every day with the dangers of COVID-19 around. In the new normal, each of the establishments around the world is implementing different measures for monitoring temperature, attendance and disinfection to make sure that none of the personnel entering the institution has symptoms of Covid-19. In the current state of technology use, the establishments are performing these routines in separate processes. First, they check the temperature, disinfect and check the attendance via logbook or biometrics. Aside from consuming much time during the process, the disinfection process only disinfects the hands using an alcohol dispenser. The risk of being a virus carrier is high. In addition, the attendance via logbooks and biometrics is one of the fastest ways of transmitting virus.

The problems experienced above pushed the researchers to conduct the research titled *Safe Booth*. Safe booth is a temperature capture, attendance recording, and an automated disinfection system using far Ultraviolet Type-C (UVC). It is a platform composed of microcontrollers and electronic circuits that records the attendance, scan for temperature and disinfect employees, students, dwellers, residents of the village, apartments, condos, and other areas where this can be utilized.

OBJECTIVES OF THE STUDY

This study aimed to develop an automated disinfection system using far UCV with automated temperature capture and attendance recording. Specifically, this sought to:

1. determine the problems encountered by persons in-charge in getting temperature, disinfection and attendance;
2. automatically determine the temperature of the person entering the establishment;
3. automatically record the attendance of the person entering the establishment; and
4. disinfect the person entering the establishment.

METHODOLOGY

This project used Agile: Scrum methodology of software engineering. It is a type of methodology that enables the researchers to deal with a task by breaking it into phases which includes consistent effort with project stakeholders and constant development and iteration in every phase. The phases of this methodology include stakeholder's meetings, product backlogs, sprint planning, sprint backlogs, the actual project sprint, daily standup meetings, sprint review, and the potentially shippable product.

Moreover, the team sat down with the Rural Health Unit (RHU), the management of Bohol Island State University – Candijay Campus and the community to identify the

problems and risks they experienced in getting the temperature, checking of attendance and disinfection. During the meeting, the stakeholders were given time to write down each challenge they experienced. Those experiences were listed as user stories. The user stories include all the stories collected from the stakeholders and the researchers. The user stories were given priority based on the urgency of needs and were given a schedule based on the availability of the team.

Using Gantt Chart, the tasks were scheduled and divided into specific workloads based on the number of persons in the team. One is in charge for the Software Requirements Specification (SRS), Hardware Development and Integration and Software Development. The scrum master conducted daily meetings to check if the project went as scheduled until the potential shippable product is achieved.

RESULTS AND DISCUSSION

1. Problems encountered by persons in-charge in getting temperature, disinfection, and attendance.

Table 1
User Stories

User Story No.	User Story
1	Getting the temperature is risky.
2	Disinfection using sprays still does not disinfect the person entering. It only limits on the hands and feet.
3	Logging in and out of the personnel is a great risk because the personnel hold same pen and paper.
4	Logging in, getting temperature and disinfection consumes time as it happens in different instances.
5	Getting the logs from the records are time consuming and risky as the log books were touched by many.
6	Must be able to print all the history of reports including all individuals entered the premises.
7	Buzzer if the person entered has a fever.

According to the stakeholders, getting the temperature is risky, disinfection using sprays does not disinfect the person entering as it only limits on the hands and feet, logging in and out of the personnel because they are using same ballpen and logbook, processes such as getting the temperature, attendance and disinfection consumes time as it happens in different instance and printing of report is harder in manual process.

Table 2
User Story Priority

Priority	User Story No.	User Story	Module
1	1	Getting the temperature is risky.	Development of automated temperature capturing module using thermal camera.
	7	Buzzer if the person entered has a fever.	Development of the buzzer module.
2	2	Disinfection using sprays still does not disinfect the person entering. It only limits on the hands and feet.	Development of the far UVC disinfection system using far UVC lamps.
3	3	Logging in, getting temperature and disinfection consumes time as it happens in different instances.	Development of attendance module using ultra high frequency radio frequency identification (UH-RID).
	4	Logging in, getting temperature and disinfection consumes time as it happens in different instances.	Integration of temperature capture, disinfection and attendance modules to perform multiple tasks simultaneously.
4	5	Getting the logs from the records are time consuming and risky as the log books were touched by many.	Development of the reports module via dashboard.
5	6	Must be able to print all the history of reports including all individuals entered the premises.	Development of logs filtering module.

Figure 2 presents the user story priority and the corresponding modules to be developed. As shown in the figure, column 1 contains the priority number, column 2 contains the user story number, column 3 contains the user story and column 4 contains the corresponding module to be developed to address the issues as listed in user stories column. The researchers added buzzer feature as they think that it is essential to have one. The core features to be developed in order to meet the expectations of the clients are the Development of Automated temperature capturing module using thermal camera, Development of the buzzer module, Development of the far UVC disinfection system using far UVC lamps, Development of attendance module using Ultra High Frequency Radio Frequency Identification (UHF RFID), Integration of temperature capture, disinfection and attendance modules. To performed tasks at the same time, Development of reports module via dashboard and Development of logs filtering module were created.

2. Scheduling of activities

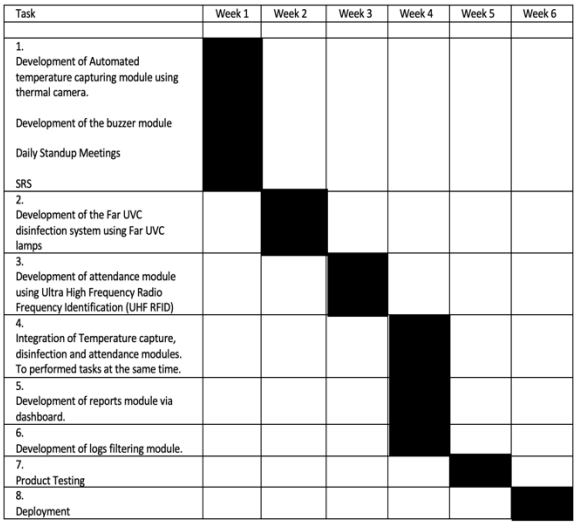

Figure 1: Scheduling of Activities using Gantt Chart

Figure 1 displays the scheduling of activities using Gantt Chart. Column 1 displays the tasks including the priority numbers and the rest of the columns displays the schedule from project kick-off to finish.

3. Automation of getting temperature, attendance and disinfection

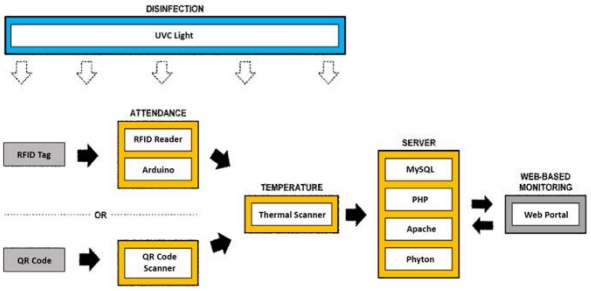

Figure 2: Process Workflow

Figure 2 is the process workflow of the system. It is a graphical representation of the system from first module to the last processes. It starts with scanning the RFID tag without tapping it to the terminal because the project uses UHF. Next is the temperature scanning using thermal camera. All the data will be sent into the database. The last core process is the disinfection using far UVC. All the data are displayed in the dashboard and can be retrieved anytime for printing.

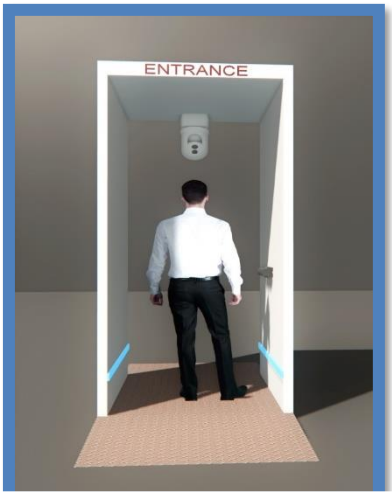

Figure 3. Prototype of Safe Booth

Figure 3 shows the prototype of the safe booth. When the person enters the establishment, he only needs to pause for a while to perform all tasks which are getting of temperatures, attendance and disinfection.

CONCLUSIONS

Living in the new normal with Covid-19, institutions are setting new rules in order to minimize the spread of the virus. Having a system that could simplify, fasten and at same time effective process of doing checking the attendance, temperature and disinfection would be a great help. This prompted the researchers to develop the Safe Booth – An automated disinfection system using far UVC. Safe booth is system that features contactless processes in checking the employee attendance, checking of temperature and disinfection in a faster and safer manner compared to the manual system. After the series of presentations and revisions, the project gained the approval of the stakeholder. To date the project waits for the funding to be fully implemented.

RECOMMENDATIONS

In order to protect our health workers, staff personnel, employees and other, this research should be pushed or its full implementation to fully maximize its potential and to give a room for its improvement. Also, the researchers believed that a further study should be done to further improve the system. With funding from the mother institution, we believe that implementing it would be a great help to the institution itself and others. The world needs to adopt in new technologies as it never stops from innovating something new for the benefit of all.

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