Development of COVID-19 Isolation Facility Management System with Scrum Framework

Sandy Darmowinoto[1*], Syed Rafi Hossain[1], Puji Astuti[2]

[1]Faculty of Computing, President University, Indonesia
[2]President Community College, Indonesia

*Correspondence: sandy.darmowinoto@president.ac.id

ABSTRACT: A COVID-19 pandemic hit Indonesia in early 2020, and on the 31st of March 2020, President Joko Widodo declared a public health emergency. By June 2021, the Delta variant hit Indonesia, causing shortages of hospital beds and resources. People who were tested positive for COVID-19 were asked to self-isolate at home. However, many houses in Indonesia are not suitable for self-isolation. Meanwhile, President University's and President Community College's students' dormitories were empty as students returned to their homes and resumed their studies remotely using online classes. Therefore, the President University Foundation decided to repurpose the students' dormitories as COVID-19 isolation facilities. To support its daily operation, an isolation facility management system was developed. To ensure the timely delivery of the system, Scrum was chosen as its development framework. Ten (10) participants tested the system for its usability, and the system scored an average of 94.5. This indicates that the developed system is easy to use and highly usable. The system was completed within a month, according to the planned schedule. The use of the Scrum framework has allowed the development team to produce a useful and effective information system in the shortest amount of time possible. Therefore, the system developed by this research provides services and facilities that are not only important in helping COVID-19 patients but also a better environment and has an integrated information system with various parties involved in handling COVID-19 patients.

KEYWORDS: COVID-19; information system; isolation facility; scrum

1. Introduction

The COVID-19 pandemic hit Indonesia in early 2020, and on the 31st of March 2020, President Joko Widodo declared a public health emergency. To curb the spread of the disease, the government enforced a large-scale social distancing policy. Experts predicted that the pandemic would overwhelm the Indonesian health system as early as March 2020 [1,2], and despite the government's best efforts to prepare for another surge, the Indonesian health system was overwhelmed by June 2021.During the month of June 2021, the number of COVID-19 cases reached 1,831,773 cases, and on average, there were 5,000 new cases daily. Indonesia's daily positive rate was the second highest in Southeast Asia after the Philippines [3]. By the end of July 2021, hospital beds were full and COVID-19 patients were denied

hospital treatments. Patients with mild to moderate symptoms were asked to self-isolate at home, reserving hospital beds for patients with the worst conditions [4]. Within a short amount of time, COVID-19 spread became uncontrollable because COVID-19 patients lacked access to proper medical care. In June 2021, there were 7,913 COVID-19 linked deaths, and by July, the death toll had reached 30,168 [5].

Self-isolating at home was dangerous for people who had displayed serious symptoms due to a lack of medical equipment and proper care. It has also led to a higher number of infections because many houses in Indonesia, especially in the urban areas, are not suitable for self-isolation due to the area's density, pollution, hygiene, and sanitation issues. Many Indonesians lack access to safe drinking water and clean water [6].

Meanwhile, President University and President Community College (private higher education institutions in Indonesia under the management of President University Foundation) have shifted all classes to online mode since April 2020 in response to the pandemic, referring to the new rules that force the teaching and learning activities to be conducted remotely [7]. This has caused a very low occupancy of students' dormitories. To help the community, President University Foundation decided to convert the student dormitories to isolation facilities for people who are COVID-19 positive but are either asymptomatic or have mild symptoms.

The health and safety protocols in the COVID-19 isolation facility differ from regular dormitory rooms due to the infectious nature of the disease. The preparation team had to first study the various guidelines [8], prepare the protocols, and get the necessary equipment. The protocols and settings were inspired by the alternate care sites (ACS) that are rapidly being constructed in the United States. Alternate care sites refer to a location converted to provide health care services when existing health care facilities are affected by disasters or when there is an unexpectedly high volume of patients, such as during a pandemic [9]. One of these ACS was developed by Staten Island University Hospital (SIUH) and used South Beach Psychiatric Facility to offload some of the COVID-19 patients from the main hospital [10]. However, because the students' dormitories lacked the equipment and clinical support from hospitals, the isolation facility set up by the President University Foundation could not handle patients with serious symptoms or comorbidities. Hence, a more careful screening process was required so that admitted patients are the ones who can do their daily activities without constant assistance from nurses.

The COVID-19 isolation facility of the President University Foundation offered a clean room with a private bathroom and toilet, internet connection via WIFI, catering service, and daily health monitoring. On top of that, the facility also allowed people to do mild outdoor exercise in the morning to speed up healing. The preparation process took two months. This included the preparation of protocols, equipment, and a management information system. The isolation facility opened its doors for patients from February 1, 2021, until the end of September 2021, and had a total of 235 patients.

To support the daily operation of the isolation facility, a management information system is quickly designed and implemented using the Scrum method. Scrum was chosen as a project management framework because it allows rapid development [11], which was desirable since the team was only allowed a month to produce a working system. However, using the Scrum framework does not mean that the development is guaranteed to be smooth and quick. As mentioned in [12,13], there are risks associated with Scrum implementation,

such as ineffective team sizes and compositions, or ineffective daily Scrum processes. These may cause slowdowns and even failure in implementation. To mitigate these risks, the project scope is kept small with the main goal of being functional in the shortest amount of time. The team is composed of developers with similar levels of experience too [14].

The developed system is a responsive-design web application developed in PHP and MySQL as its database. A web application is chosen because of the development time and fund limitations. When compared to mobile applications, web applications also have the advantage of being device agnostic, making them accessible from any device with a web browser.

2. Materials and Methods

2.1. Related work.

An off-the-shelf application that is specifically designed to support the day-to-day operation of an isolation facility is not readily available. The business process is actually a combination of a hotel management system (or often called a hotel property management system (PMS) and a clinical/hospital information system.

A hotel property management system (PMS) is a generic term to describe applications of computer hardware and software to manage a hotel [15]. Nowadays, it refers to a collection of solutions that manage the daily business operations of a hotel aimed at delivering excellent guest experiences. It typically manages the front desk, housekeeping, maintenance, invoicing, analytics, and reporting. Bigger hotels may require additional functionalities such as Meetings, Incentives, Conferencing, and Events (MICE) management and the capability to capture bookings from various distribution channels such as Traveloka, AirBnB, etc. Among the notable hotel PMS are:

- Protel Property Management System [16]
  Protel offers both cloud-based and on-premises hotel PMS. In addition to property management, it also offers event management, a booking engine, and a mobile app for guests and staff.
- Oracle's Opera [17]
  Opera is developed by one of the industry's leaders in the software field, Oracle. Opera offers comprehensive cloud-based property management and point-of-sale (POS) systems.
- Preno [18]
  Preno has a system for managing hotels that works well with a number of online travel agencies.

A hospital information system or clinical information system refers to an information system that manages the administrative, clinical, as well as financial aspects of hospitals. A hospital information system usually includes features such as: appointment management, inpatient-outpatient-operation theater management, laboratory integration, billing, and insurance. The use of information technology in managing hospitals' data can be traced as early as the late 1960s when a system called "Computer Stored Ambulatory Record System (COSTAR)" was created at Massachusetts General Hospital [19]. By now, hospital information systems have grown tremendously. Now it is not just about managing daily operations; interoperability among healthcare systems is becoming crucial. The ability of a

health information system to accommodate various devices is also important, as is the use of data tools that can provide actionable insights [20].

Another interesting category of information systems that is related to the developed system is prehospital emergency information systems. The goal of such a system is to provide prehospital services. For example, if there is an incident whereby an ambulance is required, the system sends an alert to the nearest ambulances/hospitals so they can handle it quickly, and patients' data is entered in the ambulance and sent to the hospital just in time of arrival. An example of a prehospital emergency information system is the eEKAB system [21]. The information system that will be used for a COVID-19 isolation facility should not be as complex as a hotel property management system or hospital information system. But because the patients had to stay in the facility for several days, it has a wider scope than a prehospital emergency information system. The self-isolation facility management system should be accurate, easy to use, and able to be rolled out quickly whenever an emergency calls. Once the pandemic is over, this can be shelved and used again if there is a need for a system to manage an alternate care site.

2.1. Development methodology.

The COVID-19 Isolation Facility Management System is a system designed to manage the daily operation of President University's and President Community College's COVID-19 isolation facilities. In a nutshell, this system is like a hotel property management system that tracks check-ins and check-outs but with added medical reporting features. The development of the COVID-19 Isolation facilities management system is composed of two parts:

- Early requirements gathering
- Scrum process where the system gets developed in as short amount of time as possible

2.1.1. Requirements gathering.

To understand the systems' requirements, the development team actively follows the COVID-19 isolation facility preparation process, this includes:

a) Location Setup

The COVID-19 Isolation Facility is in the student dormitories located on Jl Usmar Ismail, Kota Jababeka. There are 66 buildings located on two lanes, where each building has 10 rooms. This facility can hold a maximum of 660 patients.

Each room is identified with a code : lane-building-room_no, for example : A1-54-1, A1-54-2, etc. When it first opened up, only 11 buildings were being used, but when there was a sudden surge of COVID-19 infections, 30 buildings were allocated for isolation. Each room has an area of 255 cm x 2240 cm with either a single bed or a bunk bed for two people. Each room is equipped with:

- Pillow, bedsheets, pillowcase and blanket
- Air conditioner
- Desk, chair, lamp
- Shower and toilet
- Clothes cabinet
- WIFI for Internet access with 100 Mbps speed

The isolation facility is located in an enclosed area with 24-hour security guards on duty. One building is the office building where all equipment such as personal protection equipment, oxygen cylinders, oxygen regulators, medicines, refrigerators, and linens are stored. This is also where the supporting staff are located.

Therefore, when it comes to location management, the system requirements include:

- The system should be able to inform staffs on rooms availability
- The system should be able to manage patients' data
- The system should be able to manage staffs' data

b) Location Setup

- COVID-19 patients who wish to check in register themselves first via whatsapp or phone call and then they are asked to verify that they are asymptomatic or have mild symptoms (they do not need special assistance). If a patient is above 50 years old or has comorbidities, then they are required to show a lung X-ray result. The patient needs to agree to the pricing policy given by President University.
- Patients receive breakfast, lunch, snacks, and dinner from President University catering service; they do mild outdoor exercise guided by on-duty staff; and they get a daily check-up from a doctor or nurse. Should the patient feel that his condition has worsened, he can contact the on-duty staff that has been instructed to perform some first aid such as measuring oxygen saturation and putting on an oxygen mask. If there is no improvement, the on-duty staff will send the patient to the nearest hospital's emergency room.
- Check-out: a patient leaves the isolation facility if he has completed a minimum of 10 days of isolation for an asymptomatic patient. For a patient with mild symptoms, he has completed 10 days of isolation plus 3 days of symptoms free. A patient may leave earlier if the result of her swab test (antigen or PCR) indicates that she is negative COVID-19 A patient who wishes to move to another facility or transfers to a hospital may leave earlier too. On-duty staff will assist with the check out process, print the invoice and, when necessary, produce a letter stating that the patient has completed isolation.
- Housekeeping: housekeeping staff ensures the cleanliness of the facility, proper disposal of waste and infectious waste. To reduce contact between patients and housekeeping staff, patients are requested to pack the used linens into a bag and place them outside the room. Right after check-out, the room will be thoroughly cleaned and sprayed with disinfectant.

System requirements to support a protocol setup include the ablity to carry out the following:

- Managing check-in process
- Managing daily reports of food intake, health report and medicines
- Allowing a smooth check-out process

The interaction between various users and the system is depicted in a use case diagram as shown in Figure 1.

Figure 1. Isolation facility management system use case diagram

c) Command control setup

The management of the COVID-19 isolation facility is led by President University's Vice Rector of Resources, the management team is an ad-hoc team from President University, Jababeka Residence, and President Community College. The team is grouped based on the tasks assigned, and the groups are:

- Call center: staff that handles the call center receives whatsapp or calls from people looking for an isolation facility, states the terms and conditions of the isolation facility, assists with registration and assigns rooms.

- The Equipment team: this team ensures the availability of personal protection equipment, disinfectants, oxygen, and transportation.

- President University Clinic: The clinic ensures that all the patients in the isolation facility are checked daily by a doctor or a nurse, dispensing necessary medicines and conducting swab tests.

- Dorm managers: dorm managers ensure that catering service works on schedule and the menu is suitable for patients' conditions. They also ensure the smooth running of daily operations in the facility, like the availability of drinking water, electricity, internet connection, and housekeeping. Dorm managers send daily reports to the Vice Rector of Resources.

In the scope of this project, connection to electronic health records is not included. When the project was initiated, Indonesia's official COVID-19 tracker "PeduliLindungi" had been released but was still in its infancy. However, in the future, this system should take connectivity into account. Traditionally, the healthcare system has always been provider-

centric, meaning patients visit a hospital or clinic to get their medical care. But COVID-19 has drastically shifted this view to patient-centric, where patients may choose whether to go to a healthcare provider, choose telemedicine [22], or go to a community-based isolation facility too.

2.1.2. Scrum process.

According to the Scrum Guide, "Scrum is a lightweight framework that helps people, teams, and organizations generate value through adaptive solutions to complex problems" [23]. It can be used for a wide range of projects, including software projects. When it comes to this project, Scrum is used to organize the development team to create a truly usable system in a short amount of time. Scrum is gaining a lot of attention recently. This success is attributed to the following characteristics [24]:

- Scrum is flexible; The development team does not wait until all requirements are clear; they can start to code as soon as possible. The testing process does not have to wait until the end of the lifecycle but can be frequently done.
- Scrum is adaptable; changes in scope are welcomed while still understanding that time and costs are finite.
- Tasks are prioritized according to their importance, which means the most important task with the highest business value will be completed first. If the most important task is completed faster, the completion of the project will be faster too.
- Scrum encourages small teams that work together closely with no boss, except for the ScrumMaster who acts as a mentor. This often results in greater productivity and faster completion time.
- Scrum allows greater customer and user satisfaction. because users get to see useable portions of a completed product faster. They can test it out and give feedback immediately.

The above reasons are also why Scrum is chosen as the framework in the development of the isolation facility management system. Scrum is implemented in three steps:

- Writing the product backlogs
  Product backlogs is basically the to-do list, a list of tasks written based on the user requirements, input from various stakeholders.
- Estimating and prioritizing
  The development team, along with the Scrum Master and Product Owner, estimates the time needed to complete the tasks and each task's priority level. Irrelevant tasks will be dropped from the backlog.
- Getting to work
  Next is to decide which product backlog will be completed in a sprint and get to work. Stand-up meetings are held every day to ensure everyone in the team is aware of the progress. Progress is tracked using a burndown chart. A burndown chart refers to a line graph that shows current progress so a team can adjust their work if their actual performance is below the planned line.

In the development of the COVID-19 Isolation Facility Management system , the sprint (the time box where the team is committed to completing a certain task) duration is set for 1 week. Then the team creates a product backlog—a prioritized list of work to be completed as shown in Table 1.

Table 1. Product backlogs.

No	Product Backlog	Priority	Sprints
1	CRUD Admin and Staff	High	1
2	CRUD Room	High	1
3	CRUD Patient	High	1
4	CRUD Medicine	High	1
5	Check-in Patient	High	1
6	Patient's Medical Report	High	2
7	Patient's Medicine	High	2
8	Patient's Daily Meal	High	2
9	Check-Out Patient	High	2
10	Invoice	High	2
11	Dashboard	Medium	1
12	Logo Setting	Medium	1
13	Medicine Usage Report	Medium	1

In total, there are 13 items to be completed. Items 1–5 are to be completed in the 1st sprint. Items 6–10 are completed in the 2nd sprint, and items 11–13 are completed in the 1st sprint. The system is planned to be completed within 1 month's time. Because Scrum allows the whole team to closely monitor the progress, the system is completed within 1 month, according to the plan. The comparison between planned completion dates and actual completion dates of the tasks is shown in Table 2, and in Scrum this is also reflected in a chart called the Burndown chart, as shown in Figure 2. Such a chart allows the whole team to clearly see the development productivity.

Table 2. Planned vs actual.

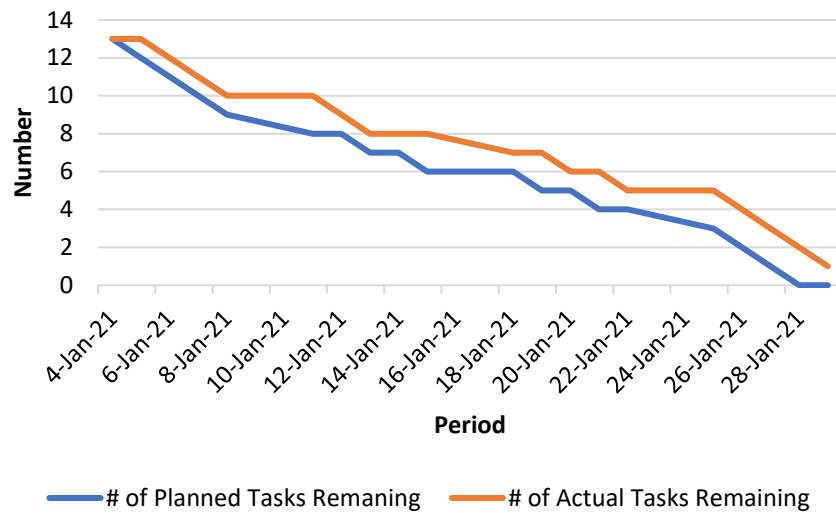| Date	# of Planned Tasks Remaining	# of Actual Tasks Remaining
4-Jan-21	13	13
5-Jan-21	12	13
6-Jan-21	11	12
7-Jan-21	10	11
8-Jan-21	9	10
11-Jan-21	8	10
12-Jan-21	8	9
13-Jan-21	7	8
14-Jan-21	7	8
15-Jan-21	6	8
18-Jan-21	6	7
19-Jan-21	5	7
20-Jan-21	5	6
21-Jan-21	4	6
22-Jan-21	4	5
25-Jan-21	3	5
26-Jan-21	2	4
27-Jan-21	1	3
28-Jan-21	0	2
29-Jan-21	0	1

Figure 2. A burndown chart.

3. Results and Discussion

3.1. Implementation.

The COVID-19 isolation facility management system is implemented as a web-based system using PHP and MySQL using the Laravel framework. The rigorous daily standups and various Scrum activities have helped in speeding up the development. The system is easy to use, and if in the future there is a need for a similar application, this system is also easy to deploy. The prototype can be accessed at http://fasilitas-isoman.net/, username: admin@gmail.com, password: 123456 . However, it is worth noting that the utilization of Scrum as a project management framework does not warrant successful development. As observed by Wonohardjo et al. [13], Scrum can be challenging to use on big projects with many team members. Another potential problem in Scrum is when the team members have different skills and experiences.

3.2. Testing.

The development team decided to use the System Usability Scale (SUS) to test that the COVID-19 Isolation Facility Management System is user-friendly and intuitive. The System Usability Scale (SUS) is a simple, ten-item scale giving a global view of subjective assessments of usability [25]. In a usability test, participants are asked about their opinion on the system by giving it a scale of 1 to 5, where 1 means strongly disagree while 5 means strongly agree with the statement [26]. The questions are:

- I think that I would like to use this system frequently.
- I found the system unnecessarily complex.
- I thought the system was easy to use.
- I think that I would need the support of a technical person to be able to use this system.
- I found the various functions in this system were well integrated.
- I thought there was too much inconsistency in this system.
- I would imagine that most people would learn to use this system very quickly.
- I found the system very cumbersome to use.

- I felt very confident using the system.
- I needed to learn a lot of things before I could get going with this system.

Equation (1) is used to obtain the SUS score from each participant [26].

$$((total\_odd - 5) + (total\_even - 25)) \times 2.5 = score \qquad (1)$$

Ten (10) participants were asked to participate in the usability testing, and this system obtained an average score of 94.5. Scores from each participant is shown in Table 3. This result indicates the COVID-19 Isolation Facilities Management system is very good when it comes to usability.

Table 3. System usability scale results.

Participant	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Score
A	4	1	4	1	5	1	5	1	5	1	95
B	4	2	4	1	5	1	5	1	5	1	92.5
C	5	1	5	1	5	2	5	3	5	1	92.5
D	5	1	5	1	5	1	5	1	5	1	100
E	5	1	5	1	5	3	5	1	5	1	95
F	5	2	4	1	5	1	5	2	5	1	92.5
G	5	1	4	1	5	1	5	1	4	1	95
H	5	1	5	1	5	1	5	1	4	1	97.5
I	4	2	4	2	5	1	4	1	5	1	87.5
J	5	2	5	1	5	1	5	1	5	1	97.5
									Average		**94.5**

4. Conclusions

The development of the COVID-19 isolation facility management system has been successful. Part of its success is the use of Scrum as its development framework, which allows it to be completed according to the planned schedule. The use of Scrum has allowed the development team to be customer-centric, hence the developed system is intuitive and user-friendly. To ensure its usability, ten (10) participants tested the system, and the system scored an average of 94.5. This means that the developed system is easy to use and highly usable. Since the opening of the isolation facility, we have accepted 235 people. People stay in the facility for an average of 10 days. The COVID-19 isolation facility management system has contributed to the smooth running of this isolation facility. Now that the COVID-19 infection rate is going down, the isolation facility is officially closed. Should there be a need to roll out an alternate care site, the developed system can be reused again with minor modification. In the future, an isolation facility management system needs to be a part of an interconnected health system. So, a patient's health records are always up to date, no matter where they get care.

Conflicts of Interest

The authors declare no conflict of interest.

References

[1] Indonesia's health system on the brink as coronavirus surge looms. (accessed 20 October 2021) Available online: https://www.reuters.com/article/us-health-coronavirus-indonesia-response/indonesias-health-system-on-the-brink-as-coronavirus-surge-looms-idUSKBN21C0J6.

[2] Indonesia's hidden coronavirus cases threaten to overwhelm hospitals (accessed 10 October 2021) Available online: https://www.theguardian.com/global-development/2020/mar/26/indonesia-could-have-thousands-of-hidden-coronavirus-cases-study-says.

[3] Arumsari, I.; Fauzi, R.; Maruf, M.A,; Bigwanto, M. (2021). Economic or public health? Southeast Asia's tackling of covid-19 a year later. *Kesmas: National Public Health Journal*, *16*, 90-96. http://doi.org/10.21109/kesmas.v0i0.5216.

[4] Hospital beds, oxygen in short supply as Indonesia wages fierce battle against COVID-19. (accessed 1 November 2021) Available online: https://www.channelnewsasia.com/asia/in-focus-indonesia-prolonged-covid-19-record-caseload-deaths-2079211.

[5] Over 2,700 COVID-19 patients in Indonesia died in self-isolation. (accessed 11 October 2021) Available online: https://www.aa.com.tr/en/asia-pacific/over-2-700-covid-19-patients-in-indonesia-died-in-self-isolation/2318314.

[6] Purnama, S.G.; Susanna, D. (2020). Hygiene and Sanitation Challenge for COVID-19 prevention in Indonesia. *Kesmas: National Public Health Journal*, *15*, 6-13. http://doi.org/10.21109/kesmas.v15i2.3932.

[7] Reine, R., Juwono, F.H., Wong, W. K. (2021). Reinventing The Future Online Education Using Emerging Technologies. *Green Intelligent Systems and Applications, 1*, 26–36. https://doi.org/10.53623/gisa.v1i1.42.

[8] WHO (2020). Repurposing Facilities for Isolation and Management of Mild COVID-19 Cases, World Health Organization.

[9] Bell, S.A.; Krienke, L.; Quanstrom. K. (2021). Alternative care sites during the COVID-19 pandemic: Policy implications for pandemic surge planning. *Disaster Medicine and Public Health Preparedness*, 1–3. https://doi.org/10.1017/dmp.2021.241.

[10] Mathews, K., Podlog, M.; Greenstein, J.; Cioè-Peña, E. (2020). Development and Implementation of an Alternate Care Site During the COVID-19 Pandemic. *Cureus*, *12*, e10799. https://doi.org/10.7759%2Fcureus.10799.

[11] Sutherland, J. (2014). SCRUM A Revolutionary Approach to Building Teams, Beating Deadlines and Boosting Productivity; Random House Business Books: London, UK.

[12] Rahayu, F.S.; Indrawan, T.; Kamarudin, S. (2020). Risk Mitigation Strategies in Implementing Scrum Framework for Internet-Based IT Companies in Indonesia. *Indonesian Journal of Information Systems*, *3,* 50–63. https://doi.org/10.24002/ijis.v3i1.3589.

[13] Wonohardjo, E.P.; Sunaryo, R.F.; Sudiyono, Y.; Surantha. N.; Suharjito (2019). A Systematic Review of Scrum in Software Development. *International Journal on Informatics Visualization*, Volume 3, 108-112. http://doi.org/10.30630/joiv.3.2.167.

[14] Tam, C.; Moura, E.J.; Oliveira, T.; Varajão, J. (2020). The factors influencing the success of on-going agile software development projects. *International Journal of Project Management*, *38*, 165–176. http://doi.org/10.1016/j.ijproman.2020.02.001.

[15] Bardi, J.A. (2003). Hotel Front Office Management; 5th ed.; John Wiley: New Jersey, USA.

[16] Cloud-Based Hotel PMS (accessed: 10 October 2021). Available online: https://www.protel.net/cloud-pms/.

[17] Hotel Property Management and POS Solutions (accessed: 05 August 2021). Available online: https://www.oracle.com/industries/hospitality/hotel-property-management/.

[18] Hotel Management Software (accessed: 02 August 2021). Available online: https://prenohq.com/hotel-management-software/.

[19] Barnett, G.O; Justice, N.S.; Somand, M.E.; Adams, J.B.; Waxman, B.D.; Beaman, P.D.; Parent, M.S.; Van Deusen, F.R.; Greenlie, J.K.. (1979). COSTAR—A computer-based medical information system for ambulatory care. *Proceedings of the IEEE, 67,* 1226-1237. https://doi.org/10.1109/PROC.1979.11438.

[20] Cresswell, K.; Sheikh, A. (2015). Health information technology in hospitals: current issues and future trends. *Future Hospital* Journal, *2*, 50-56. https://doi.org/10.7861%2Ffuturehosp.2-1-50.

[21] Mitropoulos, S.; Mitsis, C.; Valacheas, P.; Douligeris, C. (2021) An online emergency medical management information system using mobile computing. *Applied Computing and Informatics*. https://doi.org/10.1108/ACI-03-2021-0069.

[22] Zhirui, C.; Li; Borycki, E.M.; Kushniruk, A.W. (2021). Connecting the World of Healthcare Virtually: A Scoping Review on Virtual Care Delivery. *Healthcare*, *9,* 1325. https://doi.org/10.3390%2Fhealthcare9101325.

[23] The Scrum Guide (accessed 25 October 2021). Available online: https://scrumguides.org/docs/scrumguide/v2020/2020-Scrum-Guide-US.pdf.

[24] McKenna, D. (2016). The art of scrum how Scrum Masters bind dev teams and unleash agility, 1st ed.; Apress: Berkeley, USA.

[25] Brooke, J. (1996). SUS - A quick and dirty usability scale. in Usability Evaluation In Industry, 1st Ed.; Jordan, P.W., Thomas, B., McClelland, I.L., Weerdmeester, B., Eds.; CRC Press: Boca Raton, USA.

[26] Derisma, D. (2020). The Usability Analysis Online Learning Site for Supporting Computer programming Course Using System Usability Scale (SUS) in a University. *International Journal of Interactive Mobile and Technology*, *14*, 182–195. http://doi.org/10.3991/ijim.v14i09.13123.

[27] Sauro, J. (2011). A Practical Guide to the System Usability Scale: Background, Benchmarks & Best Practices. CreateSpace: Scotts Valley, USA.