A Systematic Application to Manage Residential Rental and Maintenance in Sri Lanka

MTA Wickramasinghe[1#], SHIDN De Silva[1] and D Gunasekara[1]

[1]*Department of Information Technology, Faculty of Computing, General Sir John Kotelawala Defence University, Sri Lanka*

[#] 36-it-0020@kdu.ac.lk

Abstract: *The impact of the COVID-19 outbreak was felt across all real estate management. A slowdown in the house rental and maintenance management system can be anticipated, as a result of the lock-down and limitations in financing with the most severe impact is on the inability of handling the relationship between the house owners, tenants, and the handyman. Property management is a crucial component of being a landlord, but it is far from straightforward. An appropriate methodology was carried out by the researchers to identify all the problems regarding real state property management through quantitative and qualitative data gathering procedures such as semi-structured interviews, face-to-face interviews, questionnaires, and direct observation of the selected sample. After analysing, the house owner must screen tenants, collect rental fees, handle complaints, and keep tenants satisfied, among other things. In this pandemic situation, tenants faced more difficulties such as difficulty in finding a better house, paying monthly payments, paying utility bills, loss of connection with house owners, and finding the nearest handymen. Handymen suffered a lot mainly because of the inability to find works. Researchers' main aim is to give an appropriate solution for Sri Lankans to manage house rental and maintenance. By examining the responses this investigation shows that a mobile application would be a better solution than implementing a web application. Iterative waterfall methodology was used for implementing this application. The researchers decided to develop this application using android studio. To enhance the effectiveness of the system by using 360 VR photography, Machine learning (ML)-based technologies, OTP/Fingerprint for User Verification and Geolocation, and Geo-tagging.*

Keywords: *House Rental Maintenance Management, 360 VR Photography, Machine Learning*

1. Introduction

Serious implications have happened with the Sri Lankan economy with the global crisis. The real state sector is the main sector affected due to this pandemic situation. Due to changes in the rental market, landlords reported lower rental income and lower spending to compensate for the increased risk of losing renters. There are some issues for renters to find the most suitable house. Handymen are people who suffer more by non-job during these days, and most of they haven't money to fulfill their daily tasks. Therefore, the main aim of the research was, find out the challenges faced by the tenants, handymen, and house owners in current real estate management and give them a solution by implementing an android application for house rental and maintenance management in Sri Lanka. Their main objectives of the research were,

[1] Analysing the challenges faced by users in current house rental and maintenance management.

[2] Examine the current and existing developments which have been done regarding house rental and maintenance management in both Sri Lankan and worldwide contexts.

[3] Analysing the opinion on implementing mobile applications and designing an architecture for implementing a mobile application.

It is especially important to keep an efficient communication between the landlord, tenant, and the handyman, hence the use of mobile phone applications for contact tracing during the COVID-19 pandemic, the researchers have identified that implementing a mobile application is more efficient than developing a web application.

To appropriately determine the processes and house rental and maintenance system users' requirements, quantitative and qualitative methodologies are applied. House owners, tenants, and handymen are the primary sources of collecting data by conducting semi-structured interviews, face-to-face interviews, questionnaires, and direct observation of the selected sample. Secondary data were collected through a survey conducted by house owners and tenants. Factors found to be influencing the real state of Sri Lanka have been explored using websites and literature papers of current and past decades. Technologies that were used were 360-degree VR photography that keeps human interaction in which users interact with and manipulate a simulated real or imaginary environment. Geo-Location & Geo Tagging, during pandemic situations helpful to find a nearby handyman using a variety of location-specific information and to identify the geographic location of the handyman, specifically near the specific house that needs repair and maintenance service. OTP/Fingerprint for User Verification-It is advantageous when it comes when paying rental payments, utility bills, handyman payments requests because fingerprint identification is unique, highly accurate, and simple to use. Identifying all the problems and difficulties faced by Sri Lankans, the researchers proposed an appropriate housing rental and maintenance management application.

2. Literature Review

COVID-19 has been a once-in-a-lifetime challenge for the global society and markets. Even if the situation in Sri Lanka is less serious because it can be handled with a lower number of infected people and deaths, the impact of COVID-19 on the country's broader socio-economic setting is difficult to assess. Because it has such a large impact on all market operations, real estate actors are particularly interested in the ramifications. “Whether it is a challenge or an opportunity” is a controversial theme to go forward in the market under the constricted circumstances created by COVID-19's abnormal unpredictability. However, it is possible to argue that recognizing possibilities from challenges and transforming obstacles into opportunities is the most strategic course of action in the country's real estate sector at this critical juncture.

Several studies investigations have been carried out on the obstacles and opportunities that the COVID-19 pandemic has presented to the real estate sector. The coronavirus damaged the whole market, including the global real estate industry. This is the challenge's immediate and short-term character or COVID-19's direct impact. The challenge's indirect and long-term nature can be observed if we approach it without identifying the hidden chances and taking advantage of them.

Ruzaik, F., & Begum, M. (2021) carried out research to identify the socio-economic issues that this COVID-19 pandemic has created, with a greater emphasis on human well-being. The majority of the data was derived from secondary sources. The results revealed that low-income earners, daily wage laborers, and the business community are the socioeconomically most affected persons as a result of the curfew and lockdown situation. A considerable amount of literature has been published on property management systems all around the world and in Sri Lanka in past few years. Those discussions implicate the findings to future research into this area.

In the past two decades, several numbers of researchers have sought to determine rent house management systems with basic technologies (Gommans, P *etal, 2014*) Factors discovered to be impacting the housing sector be diligent in facing the challenges of change by implementing a new strategy that allows for easy rental property administration. Existing systems having basic features such as using the command buttons to manipulate the database, having the ability to add deleting viewing, and inserting data. The role of object-oriented programming and the role of relational database management system managing mostly important task. The systems having very simple interfaces only with the details of the tenant and the property owner.

Omosebi, P. A., & Adeoye. (2016) conducted research that resulted in the creation of a web-based housing management system. The system's purpose is to manage senior staff housing and to make it easier to apply for and update housing. It also enables the housing unit to gain simple access to data, boost productivity, and reduce manufacturing costs. The approaches utilized in this study were Adobe Creative Suite 5, which was used to construct the front end, while CorelDraw Version 15 was used to design the visuals on the pages, and XAMMP Server version 5.3.5, which had PHP and MySQL applications, was used to make the site pages dynamic. Housing management systems are intended to handle data, keep track of it, and enable quick access to accommodation applications. This is necessary to establish decision-making procedures and institutional arrangements. However, suggestions for further enhancement were given, such as including a mobile alert and payment system notification. Problems of the existing system were typically characterized by paper-based information management practices; the existing system does not give room for application to be filled at convenience. Examines the flow chart, Logical view of the new system, Alternatives to the existing system, The advantages which have been identified by maintaining a web-based application were Easy deployment, Security, highly economical, Cross-platform compatibility, and easy access to the database.

These studies discussed the study of implementation of Android Applications for housing society management. Throughout the android platform, this project mainly used “Push notification Technology”. In this research Gavhane, S., *et al* (2015) discussed the disadvantages of the existing system such as unreachable information, Lack of authenticity and reliability, Time consuming activity and missing of acknowledgment. This paper proposing a smarter way of communication, fruitful solutions for Day-to-day notifications for meetings, Parking, miscellaneous contacts, security alerts. Application-based on the mobile platform it uses MVC architecture.

In 2019 Shriram, R., & Nandhakumar, P. researchers establish a web application helps the user to register individual home or apartment to assist you to find the perfect rental home or property for search view in your target area. Understanding how exhausting it is to contact individual property agents, schedule appointments, and find a better time for appointments, and supply better service. This website is designed to fulfill all needs from buying property, selling property, leasing the property. The Apartment House for Rent in Metropolitan Cities is what the Home Rental System is searching for.

This app (Nandhini, R et al, 2018) focuses on building a better relationship between buyers and sellers by simplifying many tasks such as mainly focusing on the nearest location prediction, identifying the vacant places, sending automatic rent reminders, package notifications, utility bill, emergency info, location information. In extend system added the GPS in build and giving a live chat online option. Java script technology was used for implementation. The suggested approach supposes security mechanisms using a distance-vector algorithm including the message exchange and updates message security authentication mechanism without introducing significant network overheads and complexity.

A considerable amount of literature has been published on mobile applications for real estate management in various countries. These studies Chohan, A. H. *et al* (2017)

presented a model mobile application to the automated monitoring system to determining the quality of housing to check the performance of low and medium costing and its assessment, study briefed about the transformation of empirical housing data into the integrated software to determine housing quality. This study identifies the design quality indicators and parameters for affordable housing in Karachi Pakistan, the context of quality indicators for housing design, and classified under various segments of housing design components. The need for mobile application for the housing sector was categorized as for proposing a conceptual model for the building envelope design process, proposed a model for selection of interior finishes and floor covering materials, developing an automated building element selection system.

Questions have been raised about the safety of prolonged use of appropriate things online. Kasamani, B. S., & Gikundi, D. (2017). proposing a recommendation system that allows the users to hold out a preference-based cooperative filtering search on rental properties which preferences based on shallow learning, which could be applied to ease the task of locating the desired things online. AR and Vuforia are also used to visualize the space. The system was designed as an internet application victimization handlebar for the front-end and Nodes-ExpressJs for Back-end. The system performs better than existing algorithms and predicts better in a memory-based approach. The system performs better than existing algorithms and predicts better in a memory-based approach. Recent evidence (Kim, H., *et al*, 2020) suggests the solutions for proving adequate public rental housing (PRH) with decent quality and desirable location. This study utilized a machine learning technique called long short-term memory (LTSM) to construct a set of housing price prediction models which indicate the proximity to impact on nearby housing prices at the city and the neighbourhood level of public rental housing. The approach taken by the study can facilitate improving the PRH policies and programs.

The first serious discussions and analyses of technologies that were used to improve the efficiency of real estate management applications were emerged during the 2019 s by Ullah, F., Sepasgozar, S., & Ali, T. H. (2019). Disruptive digital technologies are a necessary part of today's reality. These technologies are converting traditional industries into more innovative and adaptable ones around the world. The situation of global real estate, on the other hand, has failed to improve and is currently falling behind the technological curve. As a result of this latency, the relevant information is either not made available to end-users or is shared too late, resulting in increased risk. Users of internet real estate platforms have expressed their concerns. As a result, there are more vacancies and post-occupancy regrets among the service providers.

The Big9 technologies, which include drones, the internet of things (IoT), clouds, software as a service (SaaS), big data, 3D scanning, wearable technologies, virtual and augmented realities (VR & AR), and artificial intelligence and robotics, are assessed and addressed as the new technologies which using for real estate management.

The RESTAM framework, which focuses on online platform-based real estate users, is expected to lay the groundwork for introducing the missing technology acceptance model for real estate stakeholders, so the real estate business is transforming traditional to smart real estate because of Big9 disruptive technologies. This will lessen real estate service users' post-occupancy regrets and improve relationships amongst diverse real estate stakeholders.

Walmsley, A. P., & Kersten, T. P. (2020) found new methods for creating information-rich interactive 3D environments are becoming increasingly in demand as virtual reality (VR) and the corresponding 3D documentation and modeling technologies evolve into increasingly powerful and proven tools for numerous applications in architecture, monument preservation, conservation/restoration, and the presentation of cultural heritage. The researcher discusses the creation of an immersive virtual reality application for the Imperial Cathedral in Königslutter, in which 360° panoramic pictures were merged as a novel and complementary method of visualization within the virtual world. So those empirical studies which were published open a path for a researcher to establish this implementation.

3. Methodology

Towards an explicit research methodology adapting on the research onion model for this study is much efficient for the researchers, Research philosophy of this research is based on finding the best-suited android application for house rental maintenance management of Sri Lanka. As ongoing research, it adheres to the view that only factual knowledge is gained through the observations and measurements, the researcher conducts a positivism research philosophy. A deductive approach was conducted by the researchers through this research, investigated through examining the existing application on real estate management of Sri Lanka which was invented and used by the expertise.

As the researcher mentioned previously, the first objective of this research is to identify and analyse the challenges faced by users in current house rental and maintenance management. And the third objective of the research was to analyse the opinion on implementing mobile applications and designing an architecture for implementing the mobile application.

To discover both mentioned objectives researcher identified a specific set of people for the data collection. The specified audience were Sri Lankan tenants, handymen, and house owners. Researchers supposed that the best way of collecting data from a specified audience was through a mobile survey.

Then researcher conducted a mobile survey among a specific group of people. And researcher used to have some observations of the current situation and took some ideas from users by meeting them directly through video

conferencing. The firsthand attitudes of the community were collected by using primary sources mainly from semi-structured interviews, face-to-face interviews, questionnaires, and direct observation of the selected sample. Personal records, client histories, and service records give additional information on existing systems.

The second objective of the research was to examine the current and existing developments which have been done regarding house rental and maintenance management in both Sri Lankan and worldwide contexts. Then researchers review research papers and websites. The analysis of those papers was mentioned in the above literature review.

The researchers used several kinds of research strategies such as conducting surveys on the identified audience, understanding the grounded theories and algorithms which were used, clearly understanding the current scenario, and focusing on the best solution for recovering the problems in the current situation. Researchers use an interactive inquiry technique that combines collaborative problem-solving with data-driven collaborative analysis or research to uncover underlying causes and make predictions about personal and organizational transformation in the future. The strategy of ethnography of acknowledging the background, habits, lifestyle, behaviour, mutual differences, and the different perceptiveness of the clients. Time horizon takes a major part in research for a while, here a cross-sectional time frame was used to conduct this research at one point in time using different samples of a selected group of people and the snapshots of a given point in time change at a societal level. Requirements for the mobile-based feedback system are collected during the literature review by observing similar types of systems and fact-finding techniques. This system is technically feasible as most of the house owners, tenants, and handymen have a smartphone.

The system is developed using android studio, Android SDK, and NetBeans. The server-side language is Java and database based on cloud technology. The Google Play store sells Android apps, and researchers use the Google Pay API to integrate them. The developer even set it up to accept credit cards. To integrate the app and set it up to accept credit cards. The researcher will define the google pay API version to request a payment token for the payment provider. Then developer should define the supported payment card networks and describe all allowed payment methods. Moreover, create the PaymentClient instance by determining the readiness to pay with the Google Pay API. Then developer should create a PaymentDataRequest object for registering event handler for user gesture to handle the response object. Iterative waterfall methodology is used during the development of the system as it reduces the developer's effort and time required to detect and correct the errors. To protect the health and safety of individuals conducting surveys [15] and prevent disease transmission, the Coronavirus Disease 2019 (COVID-19) has changed how survey data is now collected. During all stages of the pandemic, data on human behaviour is needed to make effective and timely decisions. Mobile phone surveys (MPS) can provide real-time information on behaviour, exposure, knowledge, and perceptions, as well as advertising and marketing, and resource allocation. MPS have become popular in low- and middle-income nations due to increasing mobile phone penetration. MPS can be conducted without interacting with responders in person, making them particularly useful in the event of a pandemic. Rapid MPS, which requires no human resources, may reach many people in a short amount of time and is a useful tool for assessing knowledge and perceptions of an infectious illness during an outbreak as well as tracking trends over time.

A. Sample Population

The population of this research to gather data through questionnaire was selected normally from the people older than 20 years. People have been classified into three categories as house owners, tenants, and handymen. Thus, a non-random sampling method was used to select the sample among them covering several provinces in Sri Lanka. Among the identified population, about 134 sample population was selected to elaborate and collect the data while some data was collected through the research papers done regarding this field. To that, to maintain high data accuracy, a formal way has been used in collecting data.

B. Data Gathering

The survey data for this study was gathered through a questionnaire and literature reviews. The survey was conducted by delivering a questionnaire to publications and websites. This was done to collect 70 Customers or tenants, 26 house owners, and 38 handymen and the literature review was completed by consulting 15 research data extremely precisely to improve the effectiveness of the research outcomes.

4. Results & Discussion

Although the first objective of the research is to identify the challenges faced by the tenants, house owners, and handymen. As a result, the data was gathered by the quantitative approach using a survey. Those results were analysed by the researcher as mentioned below.

Roles

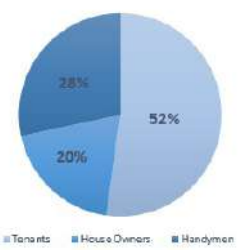

Figure 1. Designation Population Distribution

Analysis and Interpretation: As shown in Figure 1 of the 130 specimens that responded to the survey plurality of 52% were Tenants, 20% were house owners and 28% were handymen.

A. Confirmation Statements

Confirmation 1	Yes	No	Maybe	Total
Facing a lot of challenges for daily life and economy due to covid -19 pandemic	119	2	13	134

Table 1. Confirmation Statement 1

Analysis and Interpretation: Table 1 shows the responses of the sample population for confirmation statement 1 and most of the respondents have agreed with the statement by giving all together 132 responses for yes and maybe.

Confirmation 2	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
Opinion on implementing mobile application to overcome the problems in house rental and management system.	91	27	9	4	1	134

Table 2. Confirmation Statement 2

Analysis and Interpretation: Table 2 shows the responses of the sample population for the confirmation statement 2. Most of the respondents have agreed with the statement by giving all together 118 responses for agreeing and strongly agree with implementing a mobile application to overcome the problems in the house rental management system.

B. Challenges for house owners for their economy due to the covid-19 pandemic.

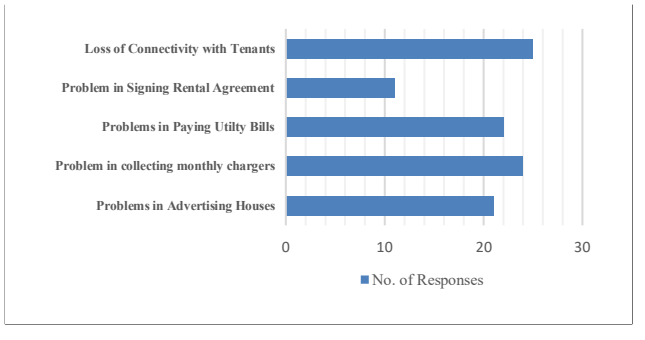

Figure 4. Challenges faced by House Owners

Analysis and Interpretation: Figure 2 shows the Challenges for house owners for their economy due to the covid-19 pandemic. Other than these challenges owners mentioned that it was very difficult to identify the nearest handymen for services.

C. Challenges faced by tenants due to the covid-19 pandemic

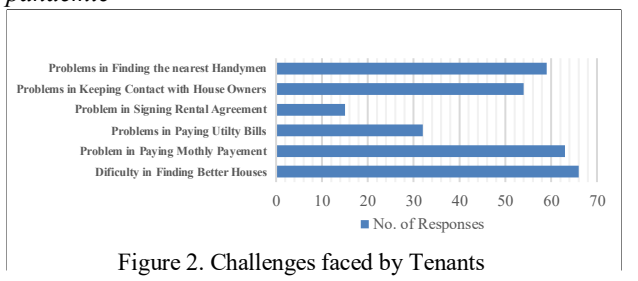

Figure 2. Challenges faced by Tenants

Analysis and Interpretation: Figure 4 shows the samples listed the attitudes on problems faced by tenants.

5. REQUIREMENT ANALYSIS

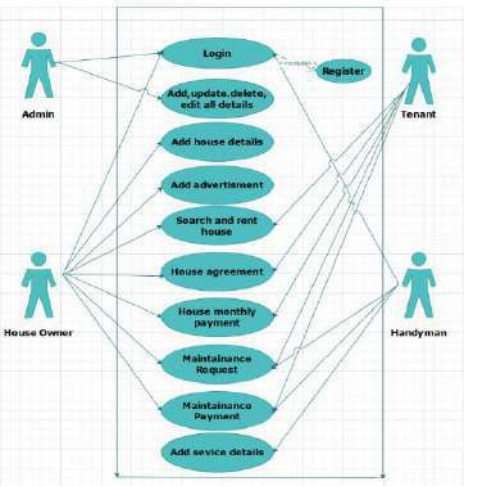

Figure 3. UML Use Case Diagram for Proposed System

There are four main user types in this system. This proposed system may be accessed by the administrator, house owner, handyman, and tenant using those four unique logins. Furthermore, each house owner and handyman have a unique username and password provided by the system when they register. The tenant can log in with their username and password, which they created when they first registered to the system. The major functional requirements are listed below.

Admin should be able to,

- Perform CRUD operations in the system.
- View house owners, houses, tenants, and handyman's details.
- Remove property advertisements.
- Update and remove owner-related house details and handyman details.

House owner should be able to,

- Add advertisements including house details.
- View appointments of tenants
- Search rented houses and tenants' details.
- View tenants' requests for maintenance.
- Sign house rental agreement with the tenant.
- Do handymen payments if need.
- Change own profile details and password.

Tenants should be able to,

- View the properties available.
- Choose suitable houses and create an appointment to meet the owner.
- Choose the nearby handyman who suits their task.
- View the details & contact the handyman.
- Pay handyman payment.
- Sign house rental agreement with the owner.
- Pay house rental fees and utility bills through the app.
- Change their profile details and password.

The handyman should be able to,

- Notifications about the requests.
- Change their profile details and password.
- Add/Update their qualifications.
- Take work from the tenants and house owners.

5. System Design

A. Technologies

This mobile application supports the following technologies. The interactive viewing of panoramic images, usually comprising a 360-degree circle or a spherical perspective, is known as VR photography (virtual-reality photography). The art of recording or generating a full scene as a single image, as seen when rotating around a single central spot, is known as virtual reality photography. The entire virtual reality image might be a computer-generated effect, or a mixture of photography and computer-generated objects, and is usually formed by stitching together a series of photographs taken in a multi-row 360-degree rotation or utilizing an omnidirectional camera. To give the best experience for tenants can optimize 360 player experiences for mobile applications, The application supports all panoramic images. Images can be captured with a 360 camera such as Ricoh Theta, Gopro MAX, Insta 360, or DSLR. Images can be rendered using 3D software. House owners could be uploaded and shared on the application. The efficiency of the application is increased as VR photography keeps human interaction in which users interact with and manipulate a simulated real or imaginary environment.

The sole purpose of the smartphone app is to make our lives easier. As a result, when developing an Android application to provide the best handyman service, it's critical to consider the consumers' ease in locating the handymen closest to them. As a result, the most significant feature in this application is the ‘Find Nearby Handyman' option. Along with the location selection, it assists users in the following ways.

Machine learning (ML)-based technologies are rapidly being employed in real estate property management to improve service quality and efficiency. In-house rental and maintenance management presents a novel strategy for precisely predicting which handymen are located. The researcher employs global positioning system (GPS) information from tenants' and house owners' mobile devices as well as Wi-Fi data that covers the whole area. researchers learn some of the user's behavioural preferences based on the prediction findings. Researchers use these projected handyman locations to give more accurate services to our tenants and house owners.

All these novel technologies that the researchers are supposed to use will enhance the system's performance. Panoramic images which were added using 360 VR photography, will help users to take an accurate imagination of the houses. And machine learning, GPS, Geo location and Geo tagging technology, which use to increase the easiness of finding nearby handymen. The authentication level of the application increased by OTP/Fingerprint.

6. Design Approach

The house rental and maintenance management system mainly consist of seven main modules. Interactive mobile prototypes were created for each module for efficient the tasks of implementation.

A. Registration and Login Module

House owners, handymen, and tenants should register for this system by themselves by entering their username and password as they preferred. Those usernames and passwords are used to log in to the system. If required users can change their passwords after login into their account. Login function should be used to access system users to log into the system. Users should already be with their usernames and passwords.

B. Administration Module

The administrator has the authority to access all the house owners’ details, property details, handyman details, and tenant details. Admin can access the system by adding, editing, and deleting, and removing the users.

C. House Rental Procedure Module

Figure 5. Mobile Prototypes for Login and Registration Module

The system provides the main function as rent a house. Property owners can advertise an advertisement to rent their houses. The owner should enter the house details which are mainly useful for tenants. owner details should be supplied for the contact purpose. House ID is auto generated when posting a house. Tenants can go through those advertisements to choose the best house by contacting using house owner details.

Mainly house owners can capture images of houses using a 360 camera and 3D software can be used for rendering the images. And those photographs can be posted with house details to give the experience of the house.

Figure 6. Mobile Prototypes for Rental House Procedure Module

D. Handymen Service Module

The main function given by the application is handyman can add their service details to the system on their own. Tenants can go through the relevant service category tenant can find the handyman who can fulfill their request and contact through handyman details. Nearest handyman, prediction is most efficient during the current situation. The handyman who is available for the chosen service category were shown on the map with their location.

Figure 7. Mobile Prototypes for Handymen Service Module

E. Rental Agreement Module

Renting a house according to the rules, regulations, and policies is the main thing to avoid conflicts. after tenants choose the best suitable house for them an agreement should be signed between the house owner and the tenant. By using this application that purpose can be fulfilled. the owner and tenant can upload and download those relevant documents and those will be fully secured.

F. Payment Module

There should be a connection between the tenant and the house owner mainly for the payment purpose. Payment services that were supplied by this application are tenants having the ability to pay monthly house rental for owners with utility bill payments and handyman service payments If not only the monthly rental payments for owners, but other bills can also be paid directly through the application. Owner and tenants can pay an advanced payment or full payment when requesting a service from the handyman. Tenants can transfer money to the handymen's bank account and the house owner's bank account through this application.

G. Notification Module

Reminders, Notifications, Emails, and Messages are compulsory in connecting the users of the application. The system should generate notifications on requests for maintenance service, tenants should be notified with newly posted advertisements, rental house payments, utility bills, and handymen payments. House owners should be notified of rental payment, tenants, and handyman requests. The handyman should get reminders on their scheduled works, tenants' requests are accepted or ignored.

After designing the flow of the application, researchers will implement this application according to conclude the analysis of the results. The application should be tested by involving a sample population and encouraging users to provide their opinion with feedback and suggestions for this application.

Finally, researchers conclude that establishing this application by targeting the real state users of Sri Lanka will effectively increase the direct communication and engagement with clients, improve customer engagement, create loyalty among users, get ahead from the competition between the companies, offers unique services, and create useful marketing in real estate industry in Sri Lanka.

7. Conclusion and Furtherwork

This paper presents a solution for problems faced by Sri Lankan house owners, tenants, and handymen during this covid-19 pandemic situation. As the mobile phone is an essential device for people in these days mobile application takes a prominent place so for further works researchers would recommend improving this android application with many more categories for users and to improve above-mentioned limitations and it would be more helpful for face the challenges in real estate industry in Sri Lanka during this covid-19 pandemic situation.

For future works, researchers plan to develop the paramedic application activating a mobile application into the IOS platform. Further, this system can be improved by using this application in both Sinhala and Tamil languages and USSD activation mode can be developed in this system as additional functionality.

References

Ariyawansa, R. G. (2020). *Is COVID -19 a Challenge or an Opportunity for the Real Estate Market and Economy of Sri Lanka? December* 1–11.

Chohan, A. H., Affandi, H. M., Awad, J., & Che-Ani, A. I. (2017). A Methodology to develop a mobile application model to appraise housing design quality. *International Journal of Interactive Mobile Technologies*, *11*(6), 4–17. https://doi.org/10.3991/ijim.v11i6.6379

Gavhane, S., Vatharkar, R., Sonar, S., & Patil, P. (2015). Study of Implementation of Society Management System. *International Journal of*

Computer Applications, *132*(1), 34–36. https://doi.org/10.5120/ijca2015907265

Kasamani, B. S., & Gikundi, D. (2017). A Location-Based Service for Handyman Order Placement. *Journal of Systems Integration*, *8*(4), 29–41. https://doi.org/10.20470/jsi.v8i4.309

Kim, H., Kwon, Y., & Choi, Y. (2020). Assessing the impact of public rental housing on the housing prices in proximity: Based on the regional and local level of price prediction models using long short-term memory (LSTM).*Sustainability(Switzerland)*,*12*(18).https://doi.org/10.3390/su12187520

Nandhini, R., Mounika, K., Subhashini, S. M., & Suganthi, S. (2018). *Rental Home System for Nearest Place Prediction*. *119*(10), 1677–1686. http://www.ijpam.eu

Omosebi, P. A., & Adeoye. (2016). Web-Based Housing Management System. *First International Conference on Advanced Trends in ICT and Management (ICAITM)*, *April 2016*.

Peter Gommans, H., Mwenda Njiru, G., Nguka Owange, A., & Proffessional. (2014). Rental House Management System. *International Journal of Scientific and Research Publications*, *4*(11), 2250–3153. www.ijsrp.org

Phadnis R, Wickramasinghe C, Zevallos JC, Davlin S, Kumarapeli V, Lea V, et al. (2021) Leveraging mobile phone surveys during the COVID-19 pandemic in Ecuador and Sri Lanka: Methods, timeline and findings. PLoSONE16(4):e0250171.https://doi.org/10.1371/journal.pone.0250171

Ruzaik, F., & Begum, M. (2021). Socio-Economic Challenges of COVID-19 in Sri Lanka. *International Journal of Scientific and Research Publications (IJSRP)*,*11*(2),185–194. https://doi.org/10.29322/ijsrp.11.02.2021.p11021

Shriram, R.., & Nandhakumar, P. (2019). House (Individual House / Apartment) Rental Management System. *International Journal of Computer Science and Mobile Computing*, *8*(9), 141–146.

Walmsley, A. P., & Kersten, T. P. (2020). The imperial cathedral in Königslutter (Germany) as an immersive experience in virtual reality with integrated 360° panoramic photography. *Applied Sciences (Switzerland)*, *10*(4). https://doi.org/10.3390/app10041517

"Landlord-Tenant Relationship Amid Covid-19" [Online]. Available: https://www.capitallawchambers.com/covid-19/landlord-tenant-relationship-amid-covid-19/ [Accessed: Sep 12, 2021]

"Sri Lanka rents falling on expat exit, Covid-19 but low rates help real estate buys [Online]. Available: https://economynext.com/sri-lanka-rents-falling-on-expat-exit-covid-19-but-low-rates-help-real-estate-buys-75179/ [Accessed: Sep 17, 2021]

"COVID-19 reshaping the Sri Lankan Real Estate Market: Impact & Outlook" [Online]. Available: https://economynext.com/sri-lanka-rents-falling-on-expat-exit-covid-19-but-low-rates-help-real-estate-buys-75179/ [Accessed: Sep 21, 2021]

"How Has COVID 19 Impacted The Real Estate Market In Sri Lanka" [Online]. Available: https://www.homelandsskyline.lk/how-has-covid- 19-impacted-the-real-estate-market-in-sri-lanka/ [Accessed: Sep 10, 2021]

"Top 10+ Real Estate App Development Companies in Sri Lanka | Real Estate App Developers Sri Lanka September 2021" [Online]. Available: https://topsoftwarecompanies.co/real-estate/app-development/agencies/sri-lanka [Accessed: Sep 24, 2021]

Author Biography

MTA Wickramasinghe is a 4th year Information Technology Undergraduate of Faculty of Computing, General Sir John Kotelawala Defence University.

SHIDN de Silva is a 3rd year Information Technology Undergraduate of Faculty of Computing, General Sir John Kotelawala Defence University.

Mrs. D Gunasekera is currently Lecturer (Probationary) at Department of Information Technology, Faculty of Computing at General Sir John Kotelawala Defence University.