

AN ECONOMIC AND SECURE PLATFORM FOR LOCATING ARTISANS AND SPARE/REPAIR PARTS DEALERS

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Abstract

Several individuals and organizations exploit the vulnerabilities inherent in genuine online interactive platforms to perpetrate fraud using various schemes. This study investigated a particular platform, artisans locating platforms that are becoming increasingly popular owing to burgeoning urbanization. The study accessed some vulnerabilities inherent in the design of the underlying applications powering these platforms by empirically testing some of them from the perspectives of specific security and economic concerns. The study observed that it was easy for fraudsters or bogus artisans to use the investigated platforms as a subterfuge for perpetrating their evil intents. The study also observed that the possibility of artisans ripping off their customers/clients through repair/spare parts prices inflation was also possible on these platforms. In addition, the usual artisan round trip of first coming to access damage prior to getting repair/spare parts to fix defective components was also inherent in the platforms investigated. To address these concerns, the study proposed that artisan platforms should be elevated to that of Internet intermediary's category, which are a group of online service providers with the additional responsibility to ensure trust. The study then conceptualized, designed, implemented and tested a platform enriched with multimedia capabilities that addressed the identified concerns

Keyword: Artisans Locating Platform, Online Applications Vulnerabilities, Multimedia Rich Applications, Secure and Economic Online Interactions, Internet Intermediaries.

1.0 Introduction

The Internet and its leading multimedia information support service, the World Wide Web (www) were designed and configured in a way that entities built on them are largely unanimous. For example, a domain name (otherwise referred to as website or portal) does not provide adequate information that can be used to ascertain its authenticity. It also does not provide ample clues that can be used to track its actual physical location if it has any. Worse still, agencies responsible for domain names registration and hosting are not under any obligation to ensure that the domain names they register are used for lawful purposes and are operated in a secure manner.

The import of these oversights is that criminals are able to register phony domain names, build and operate platforms (interactive applications powering communication and interaction) for the purpose of defrauding unsuspecting users, or for extracting vital users information for identity related frauds on other relatively secure third party platforms. And as already acknowledged, ensuring security is left at the discretion of the owners of the platforms, most of whom are not always inclined to investing in elaborate security features to protect their users. This development makes it very easy for fraudsters to perpetrate their activities, even on genuine domain names.

Expectedly, the consequence of these lapses which unduly exposes the users to financial or some other forms of losses are borne solely by the users, who under the subsisting arrangements do not have any remedies, except to remain cautious, vigilant and prayerful. In transactions conducted on phony domain names, it is most times, impracticable to track the culprits, and very often, the undesirable incidents experienced are never reported. Thus, vital information that could have provided insights into the modes of operation of criminals is lost. The situation is similar for fraudulent transactions or interactions undertaken on genuine third party domain names that results in losses for the users.

The rising incidence of frauds using phony domain names is becoming increasingly popular because of the success rate of the scheme commonly referred to as "site cloning". Under this scheme, a bogus website that is identical to a popular one (for example, a University or financial institution site) is replicated and used to deceive unsuspecting users (admission seekers or account holders) to part with cash or account information, including payment cards details. In a similar setting, some genuine sites such as social media sites, artisans and products advertising sites, allows impostors to create impressive profiles or exhibit attractive products as bait to attract users who ends up being swindled. This trend is projected to escalate as burgeoning urbanization have increased the need for urgent artisan information access. And to meet this need, artisan platforms are becoming ubiquitous on the internet.

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This mushrooming of artisans locating platforms coupled with the increasing sophistication of online related fraud schemes calls for veritable safeguards against the possible use of the platforms as subterfuge by criminals for perpetrating their activities. Already, sundry bad experiences of some of the users of these platforms are always discussed in muted tones, but never properly reported.

Therefore, to ensure that genuine artisan locating platforms do not become a safe haven for criminals, there is the need for a redesign or remodeling of its underlying applications to accommodate identity proofing requirements that the owners of the platform can use for background checks of their users. There is also the need to expand the platform features to accommodate the services of repair/spare parts dealers who are closely related to artisans.

2.0 Related Literature

Artisans and Artisans Businesses

Artisans are persons engaged in businesses or services that spans the gamut of production, transformation, repairs, delivery of a service that requires skill or a trade [1 - 6]. They are typically engaged in trade and services spanning interior decoration, roofing, plumbing, masonry and related activities, painting, plastering, joinery and locksmith, carpet and floor laying, site preparation and excavation, electricity and electrical/electronic appliances fixing, laundry and dry cleaning, hair dressing/styling, shoe and leather repairs, repair of office and IT equipment, furniture making/carpentry, pest control, repair of vehicles, general building cleaning services and other handiworks [7].

Typically, artisanship businesses are run by persons who are skilled in craft or trade and they are often flexible and resourceful in managing their businesses [8,9]. According to [7] the business of artisanship does not only include the craftsmen but also consultants, contractors, repair or spare parts dealers and others with skills for using designated equipment to work.

The class of artisans in this study focus are different from the producers of goods and services prior to the industrial revolutions of the 18th and 19th centuries.

It is predicted that the coming decades will witness the emergence and rapid growth of artisans in the economy [10]. The studies of [11] corroborates this prediction. Perhaps the boom or mushrooming of artisan locating platform attest to this prediction.

Artisans Locating Platforms

Simply put from the perspective of technology [12], artisans locating platforms are online based applications that connects enrolled artisans on such systems to individuals or organization that may require their services. They are used to advertise the artisans and their services so that they can be located in online search by users in need of such services [13 - 15]. And most have location based features that could help locate artisans that are within the vicinity [16].

Currently, several social media communication platforms (Facebook, Instagram, Twitter etc.) are used by artisans to advertise their products and services. The report of [17] exhaustively explored the use of social media platforms by artisans to advertise their products and services and to communicate with their customers or clients. Since these category of platforms were not designed originally for artisans, this study only gleaned some artisan facts from them while focusing more on platforms designated as artisans platforms.

Artisan Platforms Related Fraud

There is strong evidence that artisan platforms related fraud just like every online related frauds is never fully reported. Despite this belief, the little that is reported indicates that online fraud, including artisans platforms frauds is the most commonly experienced crime worldwide and it will continue to increase [18,19].

The challenges incidental to tackling or responding to online related frauds are daunting. Considering the lucrative nature of such frauds, criminals will continue to exploit existing vulnerabilities and emerging ones to successfully execute their attacks. This is why deliberate efforts by all stake holders (owners, managers, academia and users) at entrenching security practices in online transactions will help protect crucial business and customer information and make the Internet safer. Incidentally, there are agencies that apparently play critical roles in the online communication chains, but whose services are seemingly not clearly articulated. These agencies dubbed Internet Intermediaries, holds a crucial role in the design of some security and safety solutions in online fraud combatting. This study appreciates this role and it therefore attempts to describe it.

Internet Services Intermediaries Roles

The implicit meaning of the word intermediary is that it is located between or among two or more parties. They are described as “the go between” in local parlance. On the Internet, intermediaries help in content (information) transmission/dissemination process, only. They do not initiate decisions to disseminate content (products or services) that transverse their networks or servers. Basically, they bring together or facilitate transactions between third parties on the Internet. They give access to, host, transmit and index content (products and services) originated by third parties on the Internet. Simply put, they provide Internet-based services to third parties [20]. These special class of services providers are saddled with the following set of functions [20]:

- i. Provide infrastructure;
- ii. Collect, organize and evaluate dispersed information;
- iii. Facilitate social communication and information exchange;
- iv. Aggregate supply and demand;
- v. Facilitate market processes;
- vi. Provide trust;
- vii. Take into account the needs of both buyers/users and sellers/advertisers.

A typical example of third party services provided by Internet intermediaries are artisans locating platforms, the platforms investigated in this study. In the succeeding section, some sample artisans locating platforms developed locally are highlighted.

Sample Artisan Platforms

In the web and mobile category, we have artisan platforms such as handyman platform developed by [15] which is perceived by some as an improvement on the platform known as Handyman9ja developed by [14]. Others are Skill Locator platform developed by [21] which is particularly suitable for arranging meetings in designated convenient places and Social Radar platform developed by [22] which doubles as

a social media platform for accessing profile information of users. And for the mere fact that these platforms are all online, they have a global reach [23].

3.0 Materials and Methods

The study investigated some functioning artisan locating platforms as currently deployed based on some designated security and economic concerns. The study employed the research methods of literature search, and empirical tests in the course of the investigation. From a security point of view, the study investigated the possibility of being able to ascertain the true identities of the platform users (artisans and those in need of artisan services) by mimicking both roles. The outcome showed that it was possible to enroll as an artisans with ease on the platforms investigated. And worst still, it was possible to enroll under multiple artisan categories and to arbitrarily boost presented profiles by personally posting, and encouraging cronies to post favorable comments that can attract patronage. The outcome of the investigation also showed that all that was required to reach an artisan by those in need of service was just a scroll through a list, and may be, based on profile information, contact any desirable artisan. Either way, there are different security risks. Criminals could use such platforms to reach their victims (genuine artisans and those genuinely in need of services or products) with ease. And from an economic dimension, the study attempted to weigh the cost of engaging an artisan and getting the desired job done, promptly on the existing platforms. To carry out this task, the study used the scenario of the search and engagement of a plumber to fix a burst pipe that requires urgent fixing. One of the researchers who successfully enrolled on some platforms used for the investigations conducted in this study, was duly contacted and all the possible initial interactions to aid the timely accomplishment of the task at hand was attempted. Attempts were made to ensure that the recruited artisan fully understood all that needed to be done and all that was required to get the job done, so that he could just come over with everything needed. The outcome showed that none of the platforms used had support for the elaborate initial interactions required to achieve this objective. The recruited plumber needed to first come and access damage before proceeding to buy any required spare/repair parts needed. This implied that the existing platforms investigated only merely advertises the artisans and had no facilities for veritable initial interactions required to avoid time wasting round trips. However, for experienced users of mobile smart devices, some more elaborate description of faults was possible through the exchange of pictures and video recordings of defective components that needed to be fixed. This approach requires some little additional cost to the users, and whatever exchanges that were made using this medium will not leave any trace or trails in the platform that could be reverted to in the event of security or contract breaches.

Conceptual Solutions to the Problems Identified

To address security concerns, the study conceptualized an artisan’s platform design that requires the platform owners to make it incumbent on the users of their platforms to present some information that can be used to perform some minor identity proofing checks on the users. The platform design was also required to maintain some transactions logs of interactions performed on it. This particular concern was done in line with the Perset (2010) requirements specification for the category of services providers these platforms actually belong.

And to address the round trip economic concern, the study enriched the conceptualized design to accommodate repair/spare parts dealers advertisement and multimedia facilities for elaborate cheap initial interaction among the negotiating parties. It is noteworthy to add that this initial multimedia interactions could be done multiway to include the artisan, the repair/spare parts dealers and the user in need of service. Also implicit in this facility is the minimization of the incidence of repair/spare parts price hikes that artisans often employ to rip-off their hirers (users). The user will have the opportunity to interact with several repair/spare parts dealers for the best products and prices. Again, the conceptual design provided for the generation and storage of transaction logs besides network service provider’s logs for possible future forensic investigations.

The translation of the conceptual design into a real design using appropriate systems design methodology is presented next.

System Design

An object oriented systems design method was used in this study. Unified Modeling Language (UML) notations of use case diagrams, sequence diagrams, collaboration diagrams, activity diagram, and class diagram were used to depict the interacting entities, the processes flows among the entities, the actions of the interacting entities, the activities structure of the system and the high level interactions of the entities respectively. Figures 1a and 1b use case diagrams illustrates the platform owners (Admin) and the artisans (Users) requirements and roles specifications. Figure 1a shows that posting/management of advertisements and feedback are jointly handled by the admin and the users. This enables the admin to closely track the posting and ensure that it reflects only the category for which the user was registered. It also addresses the issue of opinion collation by some users for relevant action. Figure 1b further illustrates that the admin takes on the onerous task of artisan verification (identity proofing) to check the incidence of bogus artisans.

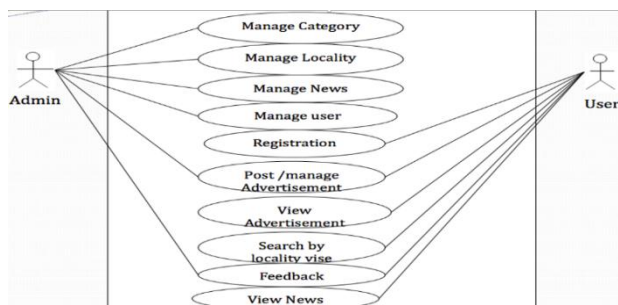


Figure 1a: Use Case Diagram (Requirements Specification/Roles)

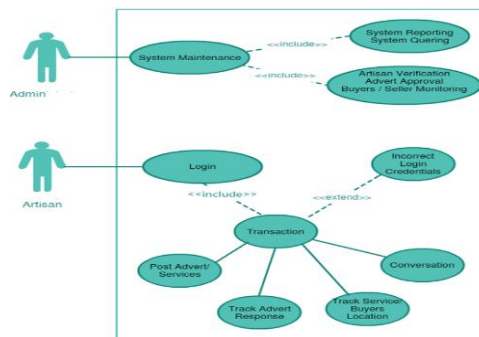


Figure 1b: Use Case Diagram (Transactions/Security Management)

Figures 2a and 2b are the sequence diagrams depicting the logical processes flows required to accomplish the desired requirements/roles and transactions/security for the Admin and the Artisan respectively. A further refinement of these processes flow is depicted by the corresponding collaboration diagrams of Figures 3a and 3b emphasizing the actions inherent in some vital processes.

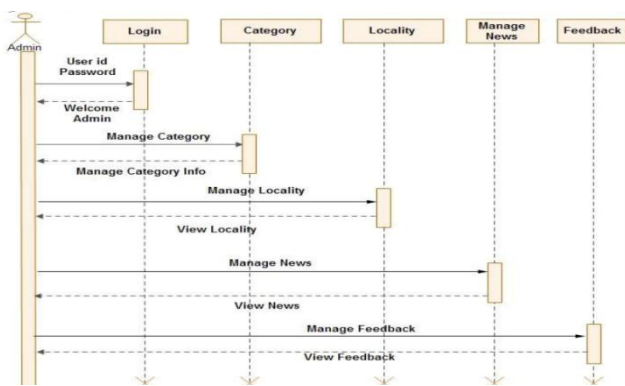


Figure 2a: Sequence Diagram for Admin

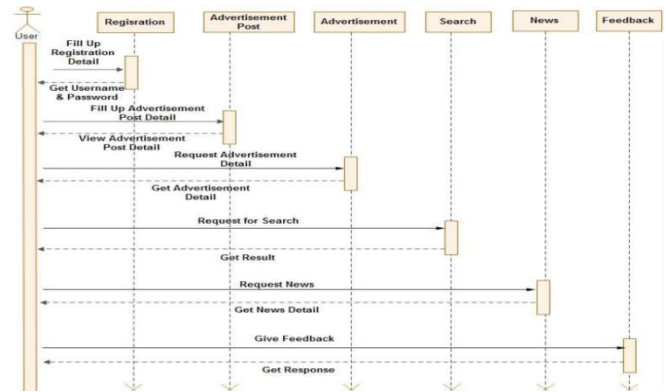


Figure 2b: Sequence Diagram Artisan

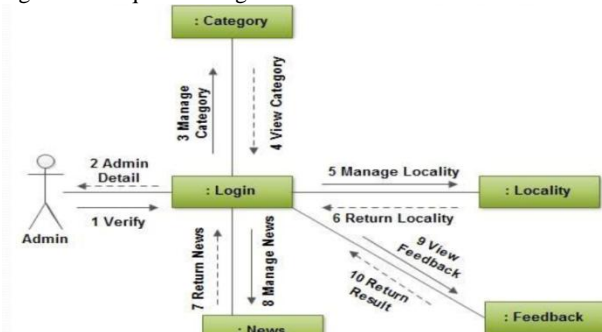


Figure 3a: Collaboration Diagram for Admin

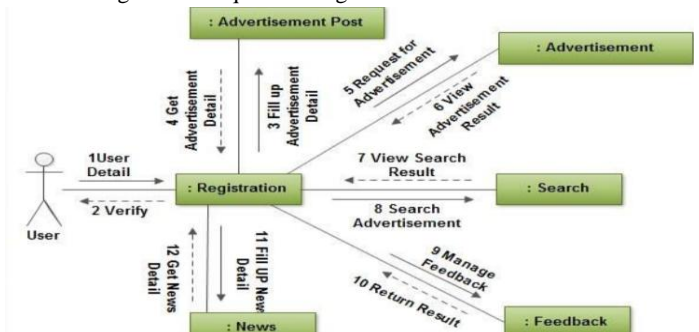


Figure 3b: Collaboration Diagram for Artisan

The combination of these processes flows and the requisite actions inherent in the flows for both the admin and the artisans constitutes the activities the entire system is required to support to achieve the desired objectives. The attainment of this logical design is represented by the activity diagram schema shown in Figure 4. The translation of these activities into module and the establishment of the interrelationships among these modules using refined semi codesthat will be implemented by requisite software tools and programming/scripting languages is illustrated by the class diagram in Figure 5.

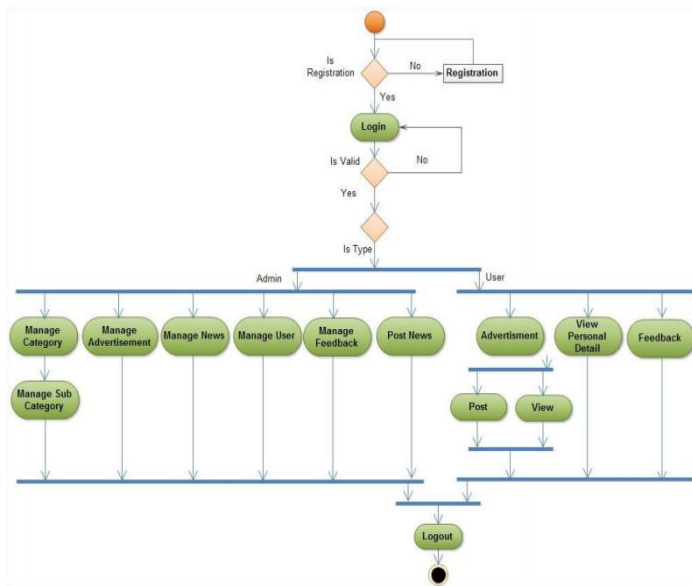


Figure 4: Activity Diagram of the System

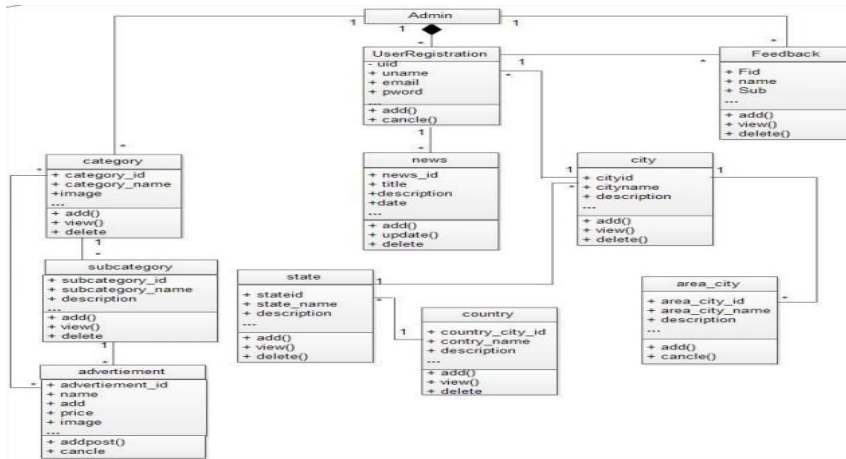


Figure 5: Class Diagram of the System

4.0 Systems Implementation

The implementation of this system was done by directly translating the class diagram of Figure 5 into a working artisan portal (platform) using some third party software tools, integrated development environments (IDE's) that facilitates the task of software building, and some suitable programming/scripting languages suitable and compatible with the (IDE's). The designated aspects of the system implementation with the described components are described as follows.

Third Party Software Tool:

The only third party software tool used was the Google Map Application Programming Interface (G-API): Google map Application Programming Interface (API) was used for mobile devices location tracking functionality. The version of the API that was compatible with the hypertext preprocessor (PHP) programming language used was downloaded and integrated into the relevant section of the written code (program).

Integrated Development Environments and Programming/Scripting Languages

Some specific IDE's that had proficient and easy to use programming/scripting languages as their integral components were used to implement the system. These IDE's and the specific aspects of the system they were used to implement are as follows:

1. **Laravel:** Laravel is an open-source PHP web framework for developing web applications based on the model-view-controller (MVC) architectural pattern. Its component PHP programming language was used to develop some aspect of the system middle end transaction (business) logic, while its MySQL database management system was used as the repository for data at the backend of the system. All web and productive mobile applications require web and mobile servers to function. These web and mobile web server facilities were provided by the Laravel framework. The framework also supported a mobile device emulator which facilitated the testing of the mobile application being developed as an integral aspect of the system. The Laravel framework allowed elaborate development and testing of the desired web and mobile features and functionalities of the system being developed.
2. **Angular JavaScript (Angular JS):** Angular JS, an open-source platform designed for building the front-end of complex web applications was used to develop the front end graphical user interfaces (GUI) of the system.
3. **Apache Cordova:** Apache Cordova, a mobile application development framework that supports the development of applications for mobile devices using scripting languages such as Cascading Style Sheet 3 (CSS3), Hypertext Text Markup Language 5 (HTML5), and JavaScript, was used to realize the mobile application aspect of this system. The motivation to use this framework and scripting languages was to develop an application that could be easily made to run (with minimal adjustments) on any mobile device operating system such as Android, iOS, or Windows.

System Testing, Documentation and Discussion

The successfully developed and tested system in the development environment was migrated to the real life productive environment for a more elaborate testing of its desirable features some of which could only work under this condition. For example, the location tracking feature could only be tested if the application was deployed online. First, the portal aspect of the system was packaged and then deployed by hosting it on a free cloud server provided by Google. Second, the developed mobile application was packaged and installed in some Android operating system based mobile phones.

On the launching of the application installed on the mobile phones, an instant connection to the portal which was already up and running on deployment was established. Figure 6 shows the opening page on one of the mobile devices used. This page is the sign in/sign up page on which the users and potential users of the platform must complete some vital checks and registration respectively. The required registration of a potential user of the system has some inherent security design. In the course of filling out the form, the user's mobile number and email address are captured for identity verification purposes. Figure 7 depicts this page. And for this initial registration process to be successfully completed, a vital process of user account verification that ties the user's account to the user's mobile phone number is carried out through the use of a one-time token. Figure 8 shows this user verification page. The other platforms investigated in this study did not have this feature. Also, to check the incidence of multiple registration under various artisan categories, this system ensures that once a mobile number and an email address has been used to register under any artisan or repair/spare parts dealer category, they cannot be used to enroll under any other category without seeking for concession from the platform admin who is expected to carry out proper background investigation.

Another unique noteworthy feature of the system is the display of artisans and the corresponding repair/spare parts dealers for that category. This feature is depicted with the auto mechanic and the auto repair/spare parts dealer's pair on Figure 6, the home page. As users of the system searches through required artisan's categories, the system automatically comes up with the associated repair/spare parts dealers for each categories, if there are any. This feature allows users of artisan services to have a good knowledge of repair/spare parts prices, which minimizes the common incidence of inflated spare/repair parts rip-offs by artisans. Having completed formal registration, the system automatically creates a dashboard (page) for each artisan and repair/spare parts dealer. The subsequent login procedures to the dashboards, the update/upload of contents and products and the user's views of artisan or repair/spare parts dealer's profile are depicted by Figures 9, 10 and 11.



Figure 6: Home page of the application



Figure 7: Sign up page

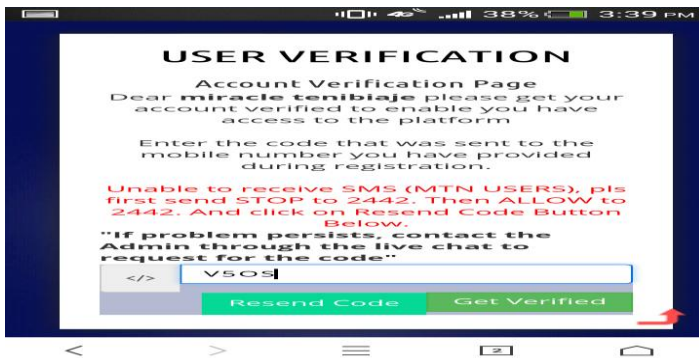


Figure 8: Verification Page

On this page (Figure 8) an alpha numeric four character code is sent as a text message to the phone number entered in the previous page. This code can only be used once. When the correct code is entered, the user details are tied to that number.



Figure 9: Registered Artisan Sign in Page

Figure 9 shows a sample registered users sign in page which requires an email address and a password to gain access to the platform. Successive sign in of registered users are logged by the system and each successful log in takes the artisan or repair/spare parts dealers to their dashboard (page) on which they can perform several actions like update their profile, upload new contents/products, view customers or clients compliments and complaints, view pending online request for their services and/or products etc. Figure 10 shows this page.



Figure 10: Sample Individual Artisan/Spare (Repair) Parts Dealers Page

While for the users (those requesting for services or products) this artisan information will appear as Figure 11, while scrolling through various artisans pages

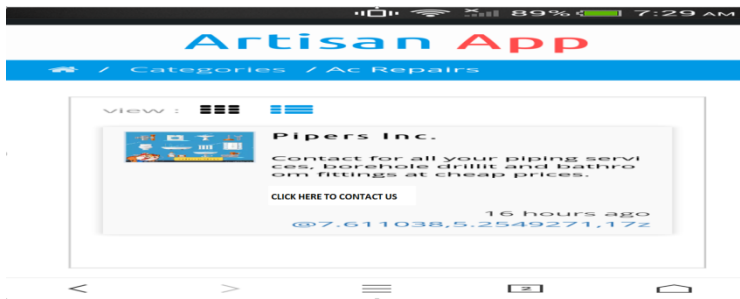


Figure 11: Sample Users View of Individual Artisan/Spare (Repair) Parts Dealers Page

Other series of tests performed with emphasis on cost savings identified to be lacking in the existing platforms investigated are illustrated next. A user flipping through the profiles of artisan, repair/spare parts dealer has the advantage of engaging them in a prior discussion using the platform multimedia messaging platform to access their competence, or to properly brief the artisan about what is required to be done. Figure 12 shows this multimedia messaging platform interface that support text messaging discussions backed up with videos, pictures and images capture and exchange. A log of the negotiations done on this platform (Figure 13) is preserved. It is accessible by only the system admin and it is reserved for dispute related scenarios as possible forensic evidence should the need arise.

Also, because of the rich set of features supported by the multimedia messaging platform, another notable possibility of an artisan remotely guiding a user to correctly install a device or fix a fault that the user, ordinarily know little about, was seen to be possible.

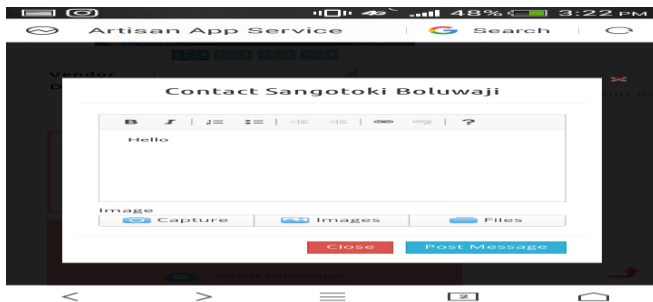


Figure 12: Multimedia Discussion Platform Page



Figure 13: Sample Artisan and User Conversation Log Page

5.0 Conclusion

The sustained growth of the contemporary internet based economy is hinged more on user’s vigilance and the security of the application platforms that supports the interactions required to conduct business. Using artisans locating platforms that have witnessed phenomena mushrooming due to burgeoning urbanization as a case study, this study observed that the first step towards achieving this noble goal lies in rethinking the approach to the design of artisan locating platforms to discourage petty crimes while providing reasonable clues or links to perpetrators. Under this proposed application design, platform owners are required to exhibit due diligence by ensuring that the artisans and spare/repair parts dealers that will use their platforms are who they claimed to be on the one hand. On the other hand, although not an integral part of the design, but for their own safety, users need to be aware of the importance of always conducting transactions on trusted platforms.

This study also introduced the idea of juxtaposing artisans and repair/spare parts dealers on the same platform, and the equipment of the platform with a multi way multimedia communication capability. These features had the inherent economic benefit of preventing users rip off by artisans from spare parts price inflation, while minimizing the costs (time and money) incidental to artisan round trips of first coming to access damage, before taking action. Also, the delivery of a multimedia supported step by step repair or installation instruction from an expert (artisan) to a novice to complete an installation or repair process also had economic gains.

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