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Development of an Online Crime Management & Reporting System

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ABSTRACT

Nowadays, much of the crimes committed were unreported to the authorities. Given this fact, the study presents the development of a Crime Management and Reporting System through online and even offline and at the same time is the active participation of the citizens. The idea draws its motivation from the inconvenience of going to the police station and personal belief of the weak investigative capabilities of the authorities to resolve petty crimes and limited spreading of crime information to the community. The project specifically looks into the crime detection and prevention. This study aims to provide an overview of the investigative process and, in doing so, identify effective and efficient approaches to the investigation and detection of the volume of crimes. The review is particularly aimed to highlight the research evidence those investigative practices and actions that are likely to lead to a positive outcome. The development of software includes the process of brainstorming and planning, requirements analysis, system analysis and designs, implementation and testing, deployment, and maintenance. The criteria of evaluation of software quality were adapted in ISO/IEC 25010:20011. This also shows that distance is also a factor that influences greatly how crimes are being handled with many crimes going unreported as a result. Crime Management and Reporting System would really help the complainant and the authority to communicate privately and easily with regards to the reported issue. In addition, it would be easier for the complainant to report a witnessed crime without the fear of getting involved in the problems because of the security that the only authorized user can see the report. Based on the findings, the researchers recommend the following for further study: widening the limit of the system by considering other cities; a generic platform for keeping human records from birth till death, deploying

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this sort of platform will serve as a source of information on persons from various states within the country and even those outside. Verification using Biometric is highly recommended to enhance the security of data stored in the system. This increases the restriction on access to the system, thus unauthorized users have no access to the system. Face recognition technology can be added.

***Keywords*:** Biometric, crime management, online, reporting system, software quality

1. INTRODUCTION

In ordinary language, a crime is an unlawful act punishable by a state or other authority. The term "crime" does not, in modern criminal law, have any simple and universally accepted definition, though statutory definitions have been provided for certain purposes [1, 5]. The most popular view is that crime is a category created by law; in other words, something is a crime if declared as such by the relevant and applicable law. One proposed definition is that a crime or offense (or criminal offense) is an act harmful not only to some individual but also to a community, society or the state ("a public wrong"). Such acts are forbidden and punishable by law [2, 15]. In many cities, the downward trend in crime has been very rapid according to the records of the Philippine National Police, the volume of crimes committed has dropped by 13 percent in 2016 and down by 21.8 percent in 2017 [3]. Showing a continuation of the downtrend in the last four years, Philippine National Police has a massive campaign against criminality; this would not be possible without the cooperation of the local residents [4, 16]. According to [36, 40], there are four things to consider in investigating a crime; note taking, securing a crime scene, the evidence management, and the scaling management to the event. But there are crimes committed were unreported to the authorities because of the fear of getting involved. Some people fail to report a crime due to the costs and time incurred in travelling to police stations that are situated far from their homes and workplaces.

This shows that the distance is also a factor that influences greatly how crimes are being handled with many crimes going unreported as a result. So, the researchers come up with the idea of making a Crime Management and Reporting System because of the awareness that nowadays, there's a lot of crime happens anywhere and going to the police department and municipality hall is a very time consuming because they are still using manual method and it takes a week or two to make an action on the said complaints. Given this fact, the researchers present the development of crime management and reporting system online and even offline. So, with the use of the system, residents would easily report the ongoing crimes and issues in their area. The system would also lessen the fear of the resident who witnesses the crime, unfortunately, one of the factors why some cases take too long to be solved.

Crime management consists of tracking and managing crimes that are committed by a small cadre whose behavior is highly responsive to a number of framing circumstances [5, 19]. A much small cadre of capable criminals may, however, create an infrastructure which greatly predisposes the delinquent group of criminals: providing drugs or an outlet for the products of car crime, for example. Disabling this infrastructure, or removing the causative agents from the scene, may have a disproportionate effect upon the levels of crime.

An additional and very important variable is the attitudes held by the population to the law and to its prosecution. Where legal structures are arcane or arbitrary, corrupt or overly-

favorable to elites - or where social change has moved the 'comfort zone' of society far from where it was when laws were enacted - then institutions will come into disrepute [6, 7, 37].

Populations may feel alienated and disaffected. They may regard those who police them as the agents of the enemy [8, 17, 38]. It is essential that police processes for investigation and crime management are proactive, clear and transparent. Without this, citizens can lose confidence in policing services and many crimes may go unreported. Public confidence in the police can often hinge on the way crimes are investigated and not simply the result of investigations. An effective crime reporting, recording, investigation, and monitoring process will change the style of policing to a victim-centered approach to crime management. This will not only enable the police to be more effective in fighting and managing crime but could also lead to a better image, reputation and more public confidence in the police force [18, 20, 39].

Crime Reporting System has been developed to override the problems prevailing in the practicing of the manual system. This software is supported to eliminate and in some cases reduce the hardships faced by the existing system. Moreover, this system is designed for the particular need of the company to carry out operations in a smooth and effective manner. This application reduced as much as possible to avoid errors while entering the data [9, 10, 40]. It also provides an error message while entering invalid data. No formal knowledge is needed for the user to use the system. Thus, by this all it proves it is user-friendly. Crime Reporting System, as described above, can lead to error-free, secure, reliable and fast management system [13, 14, 41]. It can assist the user to concentrate on their other activities rather concentrate on the record keeping. Thus, it will help the organization in better utilization of resources.

Every organization, whether big or small, has challenges to overcome and manage the information of criminal, crime, public solutions, and complaint. Every Crime Reporting System has different crime needs, therefore the researcher design exclusive user management systems that adapt to your managerial requirements.

This is designed to assist in strategic planning and will help you ensure that your organization is equipped with the right level of information and details for your future goals. Also, for those busy executives who are always on the go, our systems come with remote access features, which will allow you to manage your workforce any time, at all times. These systems will ultimately allow users to manage resources [19, 21, 42].

The main scope of this project is to develop web-based crime management and reporting system which is easily accessible to people. This system provides proper safekeeping of data and reduces the manual work. It also tries to eliminate or reduce difficulties up to some extent. The system is user-friendly and the assigned staffs can easily do their jobs without time lag. The system has a track record of each barangay in a specific municipality.

The monitoring of posts, announcements and even the wanted and missing persons and the reporting process of the system is easily accessible to people and easy to understand. It will also provide the viewing of crimes reported. It has a Summary Chart where the admin could identify the often crime happened within a month.

The administrator can post and view the important announcements and upcoming events as well as warnings to the public. The website cannot be accessed without an internet connection, but the complainant can still send reports using their phones for off-line reporting.

Only the authorized user can access some confidential part of the system such as editing, deleting, updating the crime or the criminal records and has the authorization to add other users. The system has an email verification of the registration process, but not for off-line reporting, which is calling by using mobile phones.

There is also a video limit; short video clip can only be accepted. There is an auto-reply in off-line reporting of the needed information, the message sent would be surely received, but there are times that some of the messages are delayed due to the signal status of the network and other possible reasons same as with email verification. The users should be computer literate to access the website and know how to use mobile phones.

2. PROJECT DEVELOPMENT

The researchers made use of waterfall model to develop the wayfinding system application software because it gave the researchers an easy overview of the software based on the required specifications, and to present the general flow on the development of the software application.

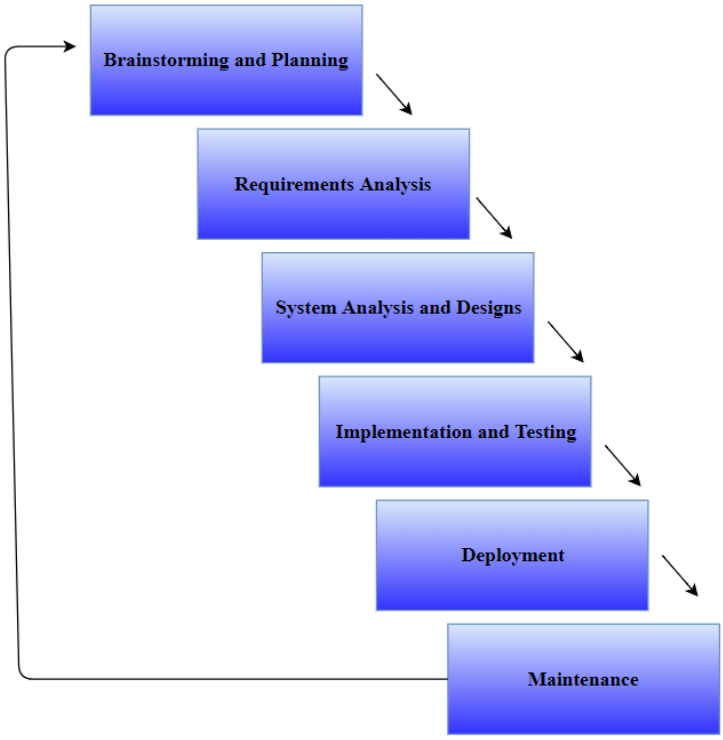

Figure 1. The Modified Waterfall Methodology

Waterfall approach was first SDLC Model to be used widely in Software Engineering to ensure the success of the project. In "The Waterfall" approach, the whole process of software development is divided into separate phases.

Figure 1 shows the model used for the software development which is the Modified Waterfall Methodology and the stages undertaken in developing the Crime Management and Reporting System. And in addition, its intensive documentation and planning make it work well for projects in which quality control is a major concern. The proponents made further adjustments to the existing system for better services and crime management.

2. 1. Brainstorming and Planning

This is the phase where the researchers had the spontaneous contribution of ideas and the process of generating each creative ideas and solutions through intensive and freewheeling discussion [22, 23, 43].

2. 2. Requirements Analysis

This phase entails the gathering of requirements from the previous and current users of the system in the process of researching, reading journals and articles, and as well as the help of the related literature and studies that the researchers gathered online [24, 25].

2. 3. System Analysis and Design

The requirement specifications are studied in this phase and the system design is conducted. The researchers studied and analyzed some of the previous and existing systems for the best results of their proposed project. All the scope and limitations of the proposed system are analyzed and improved upon. Different design tools are being used for this project, including PHP, Bootstrap, and MySQL [26, 43]. The proponents were designed the data structure based on the system requirements.

2. 4. Implementation and Testing

In this step, the proponents will start coding using HTML and JavaScript for the graphical user interface. MySQL is used in designing a robust database and PHP for the application logic which enables communication between the front-end and the backend of the system [27, 28]. And the coding and synchronizing of the software and hardware to make sure that these two components are working together.

All the units developed in the implementation phase, the entire system and the hardware used by the proponents is being tested for any errors and failures.

2. 5. Deployment

Once the functional and non-functional testing is done, the system is ready to deploy to the beneficiary. This stage involves training of the assigned officials that will be given the privilege of operating the system, populating the database with existing records, and converting such data [29, 30].

2. 6. Maintenance

Assures the system will continue to accomplish the task acquired. This includes checking for bugs and errors and ensuring that the entire system is working properly [31].

3. RESULTS AND DISCUSSIONS

Purposive sampling technique was used to select fifty (50) respondents whom to evaluate the Crime Management and Reporting System. The sampling technique concentrates on the entities that are centered on the observation of the researchers.

Fifteen (15) barangay officials and thirty-five (35) residents of Barangay Bangkal were the respondents in the study, in any gender with the range of age 18 and up and must be computer literate and at least know how to read and write. Using the purposive sampling technique, participants had an equal chance to be selected as one of the respondents. They are in the prominent position to provide the researchers with the data needed to respond to the questions of this study and they are also the ones who are the knowledgeable enough to answer the problems posed in the present study.

A modified questionnaire was used to seek the needed data in evaluating the functionalities of the system. The instrument contains name but could be optional, the designation of the respondents and the criteria used for the system's evaluation.

Criteria of evaluation include functionality, efficiency, usability, reliability, and security in evaluating the proposed project. The criteria of evaluation adopted from ISO/IEC 25010:2011 [32].

The researchers evaluated based on the Software Quality ISO Standard and with the sub-characteristics. The evaluation is divided into 5 categories: Strongly Satisfied (SS), Satisfied (S), Moderately Satisfied (MS), Dissatisfied (D), and Strongly Dissatisfied (SD).

3. 1. Mean Responses on Level of Satisfaction by Functionality

Table 1 shows that the barangay officials' average mean is 4.75 and the residents' average mean is 4.69 which are both verbally interpreted as "Strongly Satisfied." This implies that the Crime Management and Reporting System in terms of functionality were suitable, complete and correct. The data interpreted that the user obtains efficiency at the specified tasks provided by the application.

Table 1. Level of Satisfaction by Functionality

Functionality	Barangay Officials	Verbal Interpretation	Residents	Verbal Interpretation
	Weighted Mean		Weighted Mean	
Functional Suitability	4.80	Strongly Satisfied	4.74	Strongly Satisfied
Functional Completeness	4.67	Strongly Satisfied	4.69	Strongly Satisfied
Functional Correctness	4.80	Strongly Satisfied	4.66	Strongly Satisfied
Overall mean	4.75	Strongly Satisfied	4.69	Strongly Satisfied

3. 2. Mean Responses on Level of Satisfaction by Efficiency

Table 2 shows the assessment of the barangay officials and residents in the development of Crime Management and Reporting System in terms of efficiency. The results of the assessment showed that the barangay officials' average mean is 4.58 and the residents' average

mean is 4.70 which are both verbally interpreted as “Strongly Satisfied.” This indicates that Crime Management and Reporting System in terms of efficiency meet its efficiency, time behavior, and resource utilization when performing. The data interpreted that the user obtains the degree of time behavior and capacity and performance proficiency at the specified tasks provided by the application.

Table 2. Level of Satisfaction by Efficiency

Efficiency	Barangay Officials	Verbal Interpretation	Residents	Verbal Interpretation
	Weighted Mean		Weighted Mean	
Performance efficiency	4.67	Strongly Satisfied	4.63	Strongly Satisfied
Time behavior	4.40	Strongly Satisfied	4.77	Strongly Satisfied
Resource utilization	4.67	Strongly Satisfied	4.71	Strongly Satisfied
Overall mean	4.58	Strongly Satisfied	4.70	Strongly Satisfied

3. 3. Mean Responses on Level of Satisfaction by Usability

Table 3. Level of Satisfaction by Usability

Usability	Barangay Officials	Verbal Interpretation	Residents	Verbal Interpretation
	Weighted Mean		Weighted Mean	
Learnability	4.33	Strongly Satisfied	4.57	Strongly Satisfied
Operability	4.47	Strongly Satisfied	4.74	Strongly Satisfied
User interface aesthetics	4.47	Strongly Satisfied	4.66	Strongly Satisfied
Overall mean	4.42	Strongly Satisfied	4.65	Strongly Satisfied

Table 3 shows the assessment of the barangay officials and residents in the development of Crime Management and Reporting System in terms of usability. The results of the assessment

showed that the barangay officials' average mean is 4.42 and the residents' average mean is 4.65 which are both verbally interpreted as "Strongly Satisfied." This indicates that Crime Management and Reporting System in terms of efficiency meet its learnability, operability and user interface aesthetics when performing. The data interpreted that the user obtains the degree of learnability, operability and user interface aesthetics at the specified tasks provided by the application.

3. 4. Mean Responses on Level of Satisfaction by Reliability

Table 4 shows the assessment of the barangay officials and residents in the development of Crime Management and Reporting System in terms of reliability.

The results of the assessment showed that the barangay officials' average mean is 4.78 and the residents' average mean is 4.68 which are both verbally interpreted as "Strongly Satisfied." This indicates that the developments of Crime Management and Reporting System in terms of reliability are workable and has a pleasing interaction to the user. The data interpreted that the user obtains the degree of maturity, availability, and recoverability at the specified tasks provided by the application.

Table 4. Level of Satisfaction by Reliability

Reliability	Barangay Officials	Verbal Interpretation	Residents	Verbal Interpretation
	Weighted Mean		Weighted Mean	
Maturity	4.80	Strongly Satisfied	4.77	Strongly Satisfied
Availability	4.87	Strongly Satisfied	4.63	Strongly Satisfied
Recoverability	4.67	Strongly Satisfied	4.66	Strongly Satisfied
Overall mean	4.78	Strongly Satisfied	4.68	Strongly Satisfied

3. 5. Mean Responses on Level of Satisfaction by Security

Table 5 shows the assessment of the barangay officials and residents in the development of Crime Management and Reporting System in terms of security.

The results of the assessment showed that the barangay officials' average mean is 4.55 and the residents' average mean is 4.65 which are both verbally interpreted as "Strongly Satisfied." This indicates that the development of Crime Management and Reporting System in terms of security is secrecy obedient, veracity and reliability. The data interpreted that the user obtains the degree of confidentiality, accountability, and authenticity of the system at the specified tasks provided by the application.

Table 5. Level of Agreeableness by Security

Security	Barangay Officials	Verbal Interpretation	Residents	Verbal Interpretation
	Weighted Mean		Weighted Mean	
Confidentiality	4.47	Strongly Satisfied	4.66	Strongly Satisfied
Accountability	4.53	Strongly Satisfied	4.63	Strongly Satisfied
Authenticity	4.67	Strongly Satisfied	4.66	Strongly Satisfied
Overall mean	4.55	Strongly Satisfied	4.65	Strongly Satisfied

3. 6. Significant Differences in the Assessment of Barangay Officials and Residents in Crime Management and Reporting System and the GSM Module implementation

Table 6. Significant Differences in the Assessment of the Barangay Officials and Residents in Crime Management and Reporting System

Features	Barangay Officials	Verbal Interpretation	Residents	**Verbal Interpretation**
	Weighted Mean		Weighted Mean	
Functionality	4.75	4.69	1.0742	Not Significant (p = 0.2827)
Efficiency	4.58	4.70	-1.1901	Not Significant (p = 0.2340)
Usability	4.42	4.65	-1.3083	Not Significant (p = 0.0929)
Reliability	4.78	4.68	1.2771	Not Significant (p = 0.2016)
Security	4.55	4.65	-1.5511	Not Significant (p = 0.1209)

Table 6 shows the test for differences in the Assessment of the Barangay Officials and Residents in Crime Management and Reporting System and the GSM Module implementation

between two groups of respondents. It is found out that in functionality, the mean of the barangay officials which is 4.75 is greater than the mean of residents which is 4.79 with their z-test value of 1.0742.

Next is the Efficiency with the mean of 4.58 for the barangay officials who are lower compared to the mean of 4.70 for the residents with their z-test value of -1.1901. For the usability, it was found that there is no significant difference in the assessment of barangay officials and residents since the mean of 4.42 for the barangay official who is lower compared to the mean of 4.65 for the residents with their z-test value of -1.3803. In reliability, it was found that there is no significant difference in the assessment of barangay officials and residents since the mean of 4.78 for the barangay official who is greater compared to the mean of 4.68 for the residents with their z-test value of 1.2771.

Variable such as security, it was found that there is no significant difference in the assessment of barangay officials and residents since the mean of 4.55 for the barangay official who is lower compared to the mean of 4.65 for the residents with their z-test value of -1.5511.

The data implies that the assessment of the barangay officials and the residents was not significantly different as the Crime Management and Reporting System has the functionalities it is expected to have. All the stated functions of the proposed system met the satisfaction of the users.

4. CONCLUSIONS AND RECOMMENDATIONS

Crime Management and Reporting System would really help the residents to be aware and to be concerned about what is happening in their surroundings, the system makes the reporting of crime easier. The system provides users with the most reliable and complaint process. The simplicity and the friendliness are the advantages of this application. The application was made user-friendly so that anyone could access the system via login and enter their password and initially, users have all details without any risk.

The software is built with options such as the complaint registration, the area of the incident where it happens and the type of crime. In the modern world nowadays, the use of computer and mobile phones are becoming rampant that is why the researchers presented a simple but efficient, and convenient crime reporting and the requirements provided better perspective and very user-friendly and flexible for all the times.

The researchers used the Modified Waterfall methodology in the development of the system, Crime Management, and Reporting System because the approach is assertive and logical. This makes the development to be efficient. The system prototype allows users to report a crime or incident paving the way for residents to report or verify incidents by providing information about the incidents encountered or witnessed.

In addition, the reported address given by the complainant of the incidents is a great help to identify the location where common crimes happened. The result of the system showed that the potential users are willing to participate and already recognized the usefulness of the system. The willingness of the police to use the system and their recognition of its usefulness is enough to try the system for community use.

Based on the findings of the study, the researchers recommend the following for further study: widening the limit of the system by considering other cities; upgrade the system by detecting double reported crimes or incidents and examine the success of citizens' self-reporting

crimes online from the perspective of the law enforcement agencies receiving the online reports. Examining the validity of reports using the crowd is worth attention. This is a good source of information, but validation is a challenge that needs to be studied. They can add an email verification and an auto-reply SMS in an off-line reporting, which is texting using mobiles phones or tablets.

A generic platform for keeping human records from birth till death is also a good idea, deploying this sort of platform will serve as a source of information on persons from various states within the country and even those outside. Verification using Biometric is highly recommended to enhance the security of data stored in the system. This increases the restriction on access to the system, thus unauthorized users have no access to the system. Face recognition technology can be added. The researchers also recommend that the Crime Management and Reporting System will be running as an android with GPS to support the development and implementation to be accessed by the users of an operator. The plan should include the identification and prioritization of potential recipients, the appropriate method to reach each group, the resource requirements and performance measures for monitoring purposes. Therefore, Crime Management and Reporting System would indicate more of an interactive way to communicate with the users and the beneficiary of the system. The future researchers can also add a monitor for the CCTV on every street that is connected to the system so they can see how valid the report is.

5. USER'S MANUAL DEVELOPED ON THE CRIME MANAGEMENT AND REPORTING SYSTEM

5. 1. Technical Background

Technology most commonly used for better and quicker communication, which is very significant in the proposed project entitled, Crime Management and Reporting System. Online crime reporting is a convenient and presumably a good alternative way to address unreported incidents using their laptops and smartphones, individuals can file reports any time of day or night and take the time they need to report in their own words. Witnesses can use this alternative to report quality of life threats or suspicious activities that might go otherwise unreported. The researchers used a GSM Broadband stick that has a greater capacity to send and receive data. It means that data be received and sent far more quickly to and from your computer. This allows you to access the Internet, browse the web more effectively, download files faster and send and receive emails quickly. The technology was started in 1985 by a French company which is previously recognized as Group Special Mobile [32, 33]. With smart gadgets like the iPad, iPhone, Galaxy tablets, etc., users can easily have access to a vast amount of information wherever they are through the use of the internet on these devices [34, 35]. These smart gadgets make it easy to access the internet anywhere, and this simplifies the way we get information.

5. 2. Description of the Project

The project entitled, Crime Management and Reporting System, is a web-based application. This software provides the facility for online reporting, view missing and found persons, show most wanted person details, news and announcements and a lot more. Any number of clients can connect to the server. The system's website can be very useful for the police department to find out the problem in society without people are coming to the police

station every time. A complainant can access the website using the internet and even offline using their mobile phones for offline reporting. But not all the users know working with smartphones and computers very well and some of them are not computer literate. But with the above-mentioned project, all the categories can use the system. The software is made to work efficiently and effectively. It results in regular and timely action against crime reported. It can be observed that the information can be obtained easily and accurately. Better communication, reducing crime and the entire functioning less time-consuming. The main aim of this project is to secure and make the privacy of crime-related data over manually data storage. This website base project is made for providing information and awareness about crimes.

5. 3. Simulation

The researchers used Modified Waterfall Methodology for the development of the software. It is intensive documentation and planning makes it work well for projects in which quality control is a major concern. The proponents made further adjustments to the existing system for better services and crime management. These are the stages undertaken in developing the Crime Management and Reporting System

5. 3. 1. Brainstorming and Planning

This is the phase where the researchers had the spontaneous contribution of ideas and the process of generating each creative ideas and solutions through intensive and freewheeling discussion.

5. 3. 2. Requirement Analysis

This phase entails the gathering of requirements from the previous and current users of the system in the process of researching, reading journals and articles, and as well as the help of the related literature and studies that the researchers gathered online.

5. 3. 3. Implementation and Testing

In this step, the proponents will start coding using HTML and JavaScript for the graphical user interface. MySQL is used in designing a robust database and PHP for the application logic which enables communication between the front-end and the backend of the system. And the coding and synchronizing of the software and hardware to make sure that these two components are working together. All the units developed in the implementation phase, the entire system and the hardware used by the proponents is being tested for any errors and failures.

5. 3. 4. Deployment

Once the functional and non-functional testing is done, the system is ready to deploy to the beneficiary. This stage involves training of the assigned officials that will be given the privilege of operating the system, populating the database with existing records, and converting such data.

5. 3. 5. Maintenance

Assures the system continues to accomplish the task acquired. This includes checking for bugs and errors and ensuring that the entire system is working properly.

5. 4. User's Manual

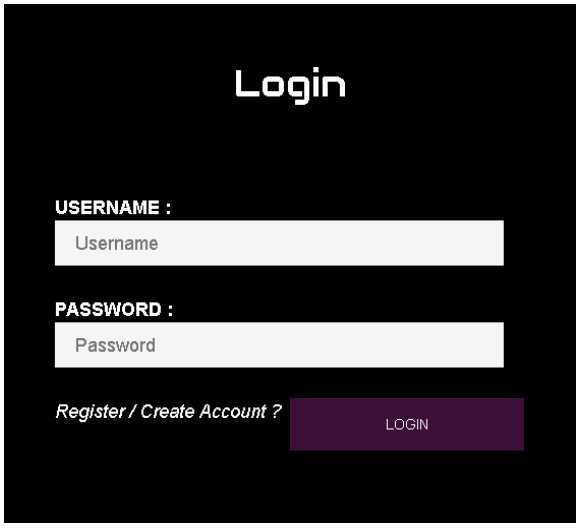

Figure 2. Login for the User

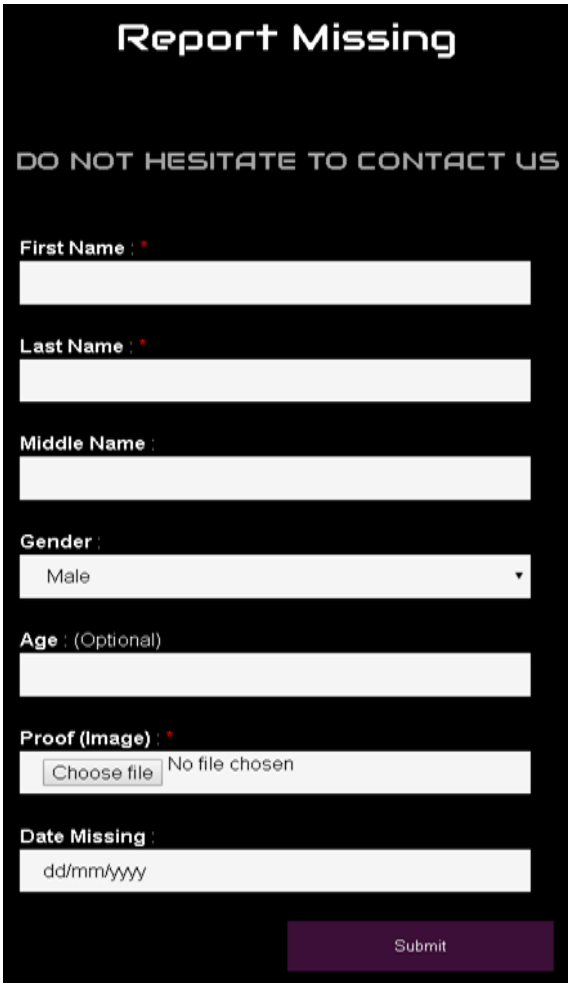

Figure 3. Reporting a Missing Person

Figure 4. Layout for News and Announcement

The registered user can now log-in using with this form shown in Figure 2. The unregistered users can view the criminal list, and the announcement and news and they can live chat with the admin through our chat box while the registered users can view the website services like reporting crime and a missing person. They can also see the announcement and news that the admin posted on the website. They can also live chat with the admin via the chat box that is on the website. The admin will be the one that can view the reported crime and missing person that has been sent. The admin is the one who can post announcements and news on the website. The registered users can report a crime by hovering through the services and by clicking the report missing links shown in Figure 3. The registered/unregistered user can view the announcements and news from the admin posted on the website shown in Figure 4.

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