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GIS TOTER: GIS Technology One Touch Emergency Response for San Pablo City

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Abstract

Maintaining peace and order is one of the important mandate of Local Government Unit (LGU). Formulating plans and recommending measures which will improve or enhance the public safety, peace and order. This study has strengthened the advance technology to set up an emergency hotline that allows every locals of San Pablo to connect on the Command Center to access the services it provides in one touch. The utilization of GIS technology is algorithmically demonstrated the predicted forecast of crimes. It helps to identify spot of the crime patterns and the socio-economic of San Pablo municipality.

This study intends to create one touch emergency response to report a location-based information with the use of GIS technology. It aims to get us aware in the surroundings to protect people and its property. This will help every locals of San Pablo City to bring this crime buster through the tip of the fingers. This is beneficial to the locals, barangay officials, police unit as well as the Local Government.

Keywords: *GIS technology, location-based information, forecast, crime patterns*

I. INTRODUCTION

The new path of technology is the digital disruption. The birth of big data and analytics directly embark the data-driven technology of the 21st century. It offers new ways in providing solutions by leveraging the dominance of information. The incursion of data creates a new channel to reshape not only the recent markets but creating the way of life.

Analytics provide a user experience to show that devices can be a one-click solution for the user's needs. This digitize interaction provides a rich information to improve not only on products but the services provided. The utilization of Geographical Information System (GIS) technology is the vital tool use in crime analysis. This crime buster tool gives the law enforcer to proactively take an action to prevent crimes.

The intense growth of crime rate over the years place Laguna province as one to have highest criminal record. Crime rate is inversely proportional to the total number of population. The urbanization of Laguna province pave way to its development and the risk to elevate the criminality records of the province.

San Pablo City is one of the Laguna's most promising City. San Pablo City Police station is operating its crime busting process in manual procedure. Paper form is one of their way in managing the records. The operation of San Pablo Police is not as accurate as it seems. There are unreported of crimes happen since, there is a lack of correct information or data that can be used to lessen or to prevent crimes with technological innovations.

This advancement attributed to the law enforcer agency to intensified the campaign against the criminality. This can be help to the agency in conducting checkpoints, identify the hotspots and potential risk. The intensifying part GIS revolved as aide partner of any law enforcer, it concentrates on

January - February 2020
ISSN: 0193 - 4120 Page No. 11956 - 11961

crime hot spot to give more visual representation to understand the geographic behavior in certain areas.

II. REVIEW OF RELATED LITERATURE

There are lots of crime problems being committed by minor offenders. With the use of Quantum Geographical Information System the authority can visualize, navigate and analyze geographical crime datasets. The police authority was required to identify those serial crimes happening in their area. These crime problems needs to be solved in such a way that the authority would easily identify locations wherein complex crimes happened.[9}

Technology may be a pervasive in current police practices, and has been for an extended time. From CCTV to crime mapping, databases, biometrics, prophetic analytics, open supply intelligence, applications and a myriad of different technological solutions take the middle stage in urban safety management. Taking one in every of the longest established technology employed in police observe, crime mapping and employing a multi-disciplinary, essential approach to flee technological solutions and bridge the gap between the educational literature and policy desires and proposals, this send a cautionary tale to those hoping that technology alone will solve advanced urban and social issues. [8]

III. CRIME ANALYSIS AND GIS ONE TOUCH EMERGENCY RESPONSE

Crime analysis is an evolving ground; it demonstrates a number of studies to objectively make possible for government authorities to suppress crime in the community. The major changes in globalization lead to increased opportunities “intelligence-led” style crime control tactics. Instead of aiming at the detection of crimes, it is focus to disrupt criminality to reduce its gravity to occur [1]. It defines the characteristic of the crime activity in order to develop strategic action plans to effectively fight it. Crime analysis can be defined as the study of day-to-day reports, identify the location, time of day, faces of crime. It also isolates the actuality of criminal behavior patterns [2]. It enhances law enforcer intelligence; it acts as analyzing crime by breaking up of acts committed in violation.

GIS platform provides a geographic profiling to study facet of crimes. This is an exploratory approach that can determine the area and the connected series of crimes constrained. Space had direct connection to situation. Geography plays an important role in innovating police agencies towards to crime reduction and public safety. The information age initiate these patterns and trends use to identify the hotspots and look for frequencies of crime committed. The advancement of technology opens the possibilities to use the geographical components to map the crime.

One Touch Emergency Response is an immediate assistance dedicated to the every local of San Pablo Laguna, one of the Region Province of the Philippines. This technology with the merge of Geographical Information System (GIS) puts up this interactive tool to aid local law enforcer to provide the public an effective device to manage offenses.

Philippines is reported as the texting capital in Asia, the prevalent usage of mobile phone gives insights of widespread usage of mobile application to facilitates one click emergency response to create connection to the Command Center to aggregate crime information and encourage civilian to report offenses. This interactive project has a Control Center that responds to user after sending notification by pressing the emergency button. The Control Center call the user to get essential information about the incident transpired. The Control Center contacts the nearest government response authority to give assistance.

Geographical Information System (GIS) together with crime mapping and crime analysis are the crucial tools in helping to minimize or solve the criminal activity in one location. The accessibility

January - February 2020
ISSN: 0193 - 4120 Page No. 11956 - 11961

of geographic data makes it possible. The utilization of crime mapping and GIS gives shape to identify the hotspot of the crime. With this information the law enforcer can strategically can plot prevention or resolution before it will become challenging. [6]

Crime pattern can help the authorities to maintain the peace and order. It can be used to evaluate the crimes recorded to focus on the areas and the types of criminality with high frequencies. The legends signify each crime rates present in San Pablo City.

The crime pattern is limited on the major region of San Pablo City. The crime activity will shoed on the system only be based on the input of the command center that was reported to them through phone or in personal.

IV. DATA IN SAN PABLO LAGUNA

New technologies emanate variation of means for law enforcement agencies to suppress criminality. Mobile application plays a big role to help civilian and authorities hand in hand to combat criminality. It serves as a tool to report the incident. Through this, it allows the control center to locate the incidents, map the destinations. This technology serves as a tool to report the incident. The authorities permit to study and associate facts as the basis to produce detail incidents and related factor within the community.

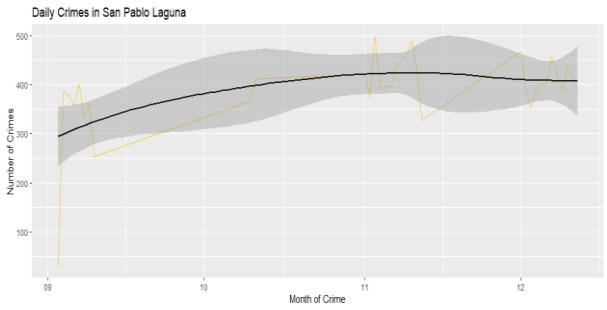

Figure 1. Crimes in San Pablo from September - December 2017

San Pablo was formerly known as old Sampaloc. It was derived to "San Pablo delos Montes," originated to Saint Paul, is one of the mountainous region in Laguna that envision a progressive hub eco-tourism and information technology development [3].

The development of Tourism at San Pablo Laguna ventures the increase of population and acquaint guest from different places that can lead into possible occurrence of crime. Security is one major fact in terms of economic tourism. Several studies indicated that the crime and tourism is directly related to each other. It shows the relationship is undoubtedly directly proportional to each other.

Crime prevention is not a new idea, majority of police stations in the Philippines are still practicing manual procedure in managing records by simply filing it in folders and using paper forms as incident or crime templates. Mapping was done by manually drawing the map of San Pablo using Paint to track the possible crime trends. This condition triggers the researcher to develop a system to improve the mapping scheme to operate the San Pablo Police station in a modernized way, managing records in an easy task, identify the hotspots area and to increase the citizens' awareness. Stretching their participation to initiate their responsibility in crime reduction and prevention.

The challenge does not stop on deriving information. Crime data composed of both spatial and temporal attributes. The spatial aspect includes the observation of regions characteristics over time. The temporal dimension involves features of region over time. The researchers use the crime data for San Pablo Laguna which are available from the month of September to December in the year of 2017 as the test data. Organizing data takes time. The proponents need to understand how data are organized and what categories are needed for the study. DT and data table function used to display the data.

January - February 2020
ISSN: 0193 - 4120 Page No. 11956 - 11961

V. METHODOLOGYAND DATA

A. Methods of Research

Applied research is the foundation of applied evidence- based research. This study is upon the application of an app crime patterns. It is a systematic approach whose purpose is to aggregate information based on the historical data, patterns, locations and category needed to identify geographic patterns of crime. The study focuses its attention on environmental factors that can possible promotes crimes.

B. Data Gathering Procedure

The app serves as a connection button to the command center. Once the user presses the button from the app, it sends signal to the command center, the command center will call the user of the app to collects the relevant data such as name of the victim, type of incident and location. From the database of the command center, the data will be download and save it into an excel file for processing. The data presented by using the data table to display all the collected raw data.

Show 5 entries Search:

	REGION	SOURCES	DATE	TIME	DAYOFWEEK	DESCRIPTION	LOCATION	ARREST	DOMEST
1	BAGONG BAYAN	PNP BLOTTER	12/12/2017	23:54:00	Tue	BURGLARY	PRIVATE/PUBLIC BUILDING	NONE	NONE
2	CONCEPCION	BRGY BLOTTER	12/12/2017	23:40:00	Wed	INJURY	RESIDENCE	NONE	YES
3	DEL REMEDIO	OLEA	12/12/2017	23:40:00	Thu	BURGLARY	RESIDENCE	NONE	NONE
4	II-E	PNP BLOTTER	12/12/2017	23:30:00	Fri	THEFT	PARKING AREA	NONE	NONE
5	SAN DIEGO	BRGY BLOTTER	12/12/2017	23:30:00	Sat	THEFT	STREET	NONE	NONE

Figure 2. Summarize the data by Incident Category

In lieu in this study the researchers use the 2017 selected data. Before treating the data, the researcher needs to identify the category and determined the fields to be used. The researchers used different function in treating the data. The observation has been set to provide the detailed information associated on its set of incident. The date plays the important role, to see the characteristic of date, time stamp is used to give appropriate date of crime incident happened. The date and time is separated using the chron library function in R.

C. Data Visualization

The visualization of data convenes the data staging. This is the quantitative data sets into a graphical form to expose the trends, correlations or patterns.

This section shows the 1 to 6 top crime entries in San Pablo Laguna. Theft and violations show the dominance in dispersal based on time and day.

Show 10 entries Search:

	Category	Frequency	Percentage
1	Theft	4807	0.352755558817054
2	Violation	2317	0.170030087326631
3	Nonviolation	2231	0.16371908710648
4	Injury	893	0.065531665076686
5	Assault	747	0.054817641447127
6	Burglary	565	0.0414618037719234

Showing 1 to 10 of 12 entries Previous 1 2 Next

Figure 3. Top Crime Category in San Pablo Laguna

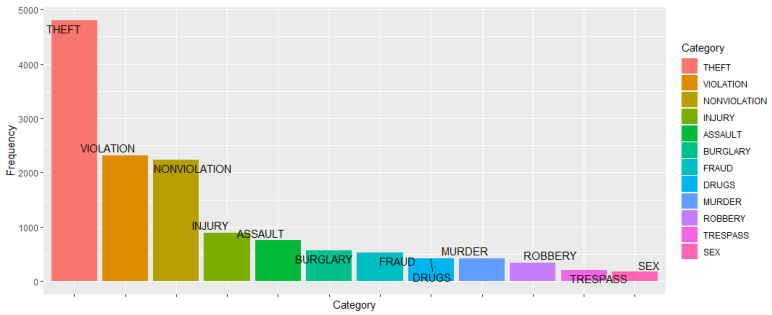

Figure 4. Frequency of Different Crimes in San Pablo Laguna from September - December 2017

This graph shows how attention-grabbing the distribution of crime incident in San Pablo, Laguna with respect of time, day and month.

A Crime over Time is used to demonstrate the record of crimes from historical year until the future year. The researcher uses the scale_y_dateto show the daily crimes in San Pablo.

D. Crime Analysis

Crime analysis is defined as a set of systematic, analytical processes directed at providing timely and pertinent information relative to crime patterns [4]. The analysis is done using Pearson Correlation coefficient to gauge the relationship between the variable used in the study.

January - February 2020
ISSN: 0193 - 4120 Page No. 11956 - 11961

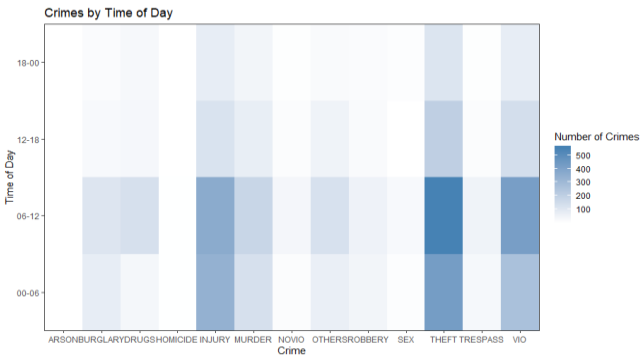

Figure 5. Crimes by time of day in San Pablo Laguna, 2017

The heat map shows the manifestation of crime with respect to the time dimension. The plot shows the association of corresponding periods. This prove final hours observe more crime from the other hour speculated. There a heave at 6:00 pm to 12:00 midnight on weekdays.

On the other side, the heat map shows which region in San Pablo had the highest chance of crime activities compare to Police arrest. This also shows that most of the crime activities happened on November to December. The figure shows the incline of crime volume. This demonstrates the trend of crime spikes during the "ber" months due to the bonuses and 13th month pay that the workforce receives.

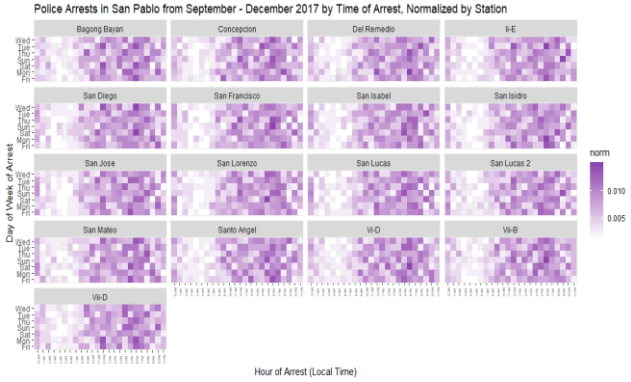

Figure 6. Heat map of Regions in San Pablo

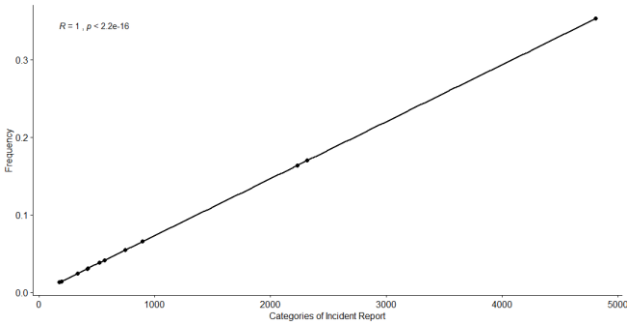

Figure 7. Correlation plot

The proponents use the correlation to establish the relations of the variables. It shows the linear positive connection between the quantitative measure of variable. There are certain areas that shows between the time the people leave at work, or the population traffic during the weekend, where different guests are coming to visit the tourist places in San Pablo.

This reports may use by the authorities to intensified their campaign against all forms of criminality. It helps also the public cooperate with the authorities and be vigilant on public safety.

VI. CONCLUSIONS

The law breakers physical area and crime spot are important components of the criminal event. That is why, the GIS can be used in crime mapping in analyzing and to determine crime activities and trends.

The discoveries of the study show that using the GIS and the mobile app provided a valuable information and secure an assistance for the locals and visitors of San Pablo Laguna. The p-value of the test is greater than the significance level. This give us a conclusion that the percentage of incident category and the frequency per time, day and months are positively significantly correlation with a coefficient of 1. The confidence interval is at 95% and indicates a strong positive correlation with the dependent and independent variable.

The analysis shows that most of the crime happened at hour from 6:00 pm to 12:00 mid-night. This is the reason why the time pattern predicted that those time the incident might happen again.

January - February 2020
ISSN: 0193 - 4120 Page No. 11956 - 11961

Furthermore, based on the data, theft, physical injury and police violations are highest in the city. It drawn also the peak months, where this crime at on high level, this indicates that the season of from November to December, spikes the criminal activity, it indicates the pre-Christmas and Christmas season in the Philippines, wherein a lot of Filipino have their bonuses and 13th month pay. The solution on this crime fall on the full cooperation of the Locals, the Local Government and the Authorities.

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