Geoinformatics For Police Station – Wise Major Crimes Analysis In Tiruchirappalli City, Tamil Nadu

P. Mary Santhi*
*Research Scholar, Department of Geography
Periyar E.V.R. College (Autonomous), Tiruchirappalli – 620 023
S. Balaselvakumar*
*Assistant Professor, Department of Geography
Periyar E.V.R. College (Autonomous), Tiruchirappalli – 620 023
Affiliated to Bharathidasan University, Tiruchirappalli – 620 024
K. Kumaraswamy
**ICSSR Senior Fellow - Emeritus Professor
**Department of Geography, Bharathidasan University, Tiruchirappalli – 620 024

ABSTRACT

This research is an attempt to study the major crimes police station-wise in Tiruchirappalli city. It reveals that Woraiyur (14.1%) and Srirangam (12.1%) police stations of Srirangam range, recorded the maximum major crimes. The maximum of robbery (57.3%) and a minimum of murder for gain (1.1%) and dacoity (0.7%) were reported. The maximum of major crimes (60.0%) was recorded in all the police stations of Srirangam range in 2014 and minimum (6.2%) was reported in all the police stations of Golden Rock range in 2014. Therefore, it is suggested that to setup police stations and their forces to be increased in proportion to the total population, hourly police patrolling during day and night, installing CCTVs cameras, preparing crime maps and city action plan periodically and systematically and knowing the crime-prone areas will help to reduce the major crimes in the city especially in Srirangam range.

KEYWORDS

Major crime-wise, Police station-wise, Year-wise, Srirangam Range, Geoinformatics, Crime mapping

INTRODUCTION

A crime that hinders economic development and overall prosperity is an issue in every part of the world. In many countries, the ever-growing population, coupled with limited resources, is the major cause for problems such as poverty, unequal distribution of income and wealth, unemployment, lack of health and inadequate sanitation facilities. Countries rife with such problems have a strikingly high crime rate due to these socio-economic factors. Crimes create a feeling of terror and insecurity among citizens and cast a shadow over a country and its people. The crime rate may vary from region to region and from time to time.

Over the decades, crime rates have risen due to overpopulation, corruption and even hi-tech development have brought complexity and perfection to the mode of crimes in most of the cities. There have been limited studies concerned about police station – wise analysis of crimes such as Softley, P., et.

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al.(1980) discovered the nature of evidence against suspects for selected categories of crime; Demombynes, G., and Özler, B. (2002) examined the effects of local inequality on property and violent crime in South Africa; Del Frate, A. A., and Del Frate, A. A. (1998) studied the levels and effects of victimization; Ansaril and Kale (2014) have conducted a study of mapping and analysis of crime hotspots like murder, day housebreaking and night housebreaking; Derek (2004) has examined the method of assessing crime maps for police officers; Firoz Ahmad et al. (2018) attempted the role of geospatial techniques in crime mapping such as murder, rape, kidnapping, dacoity, burglary, theft and riots to understand the crime trend; Ravi Sharma et al. (2016) analysed crime mapping for crime direction, hotspots of crimes, type of hotspot, the proximity of crimes to police stations, displacement of crime across time, the crime rate of each ward and the social-economic characteristics; Saravanakumar and Revathy (2016) studied crime-mapping analysis for crime hotspots, type of hotspot and relative information for police; Vidushi Marda and Shivangi Narayan (2020) applied Crime Mapping, Analytics and Predictive System (CMAPS) for live spatial hotspot mapping of crime, criminal behaviour patterns and suspect analysis; Sohn, D. W. (2016) assessed the relationship between residential crime and the built environment that reflects the principles of Crime Prevention Through Environmental Design (CPTED) at the neighbourhood level; Day; P., et, al. (2012) scrutinized the association between geographic access to alcohol outlets and serious violent crime in New Zealand; Skogan, W. G. (1984) used the sample surveys of the general population to study the crimes; Ratnayake, R. M. K. (2015), studied the relationship between crime and geographic environment for identification of crime locations; Mohammed, A. F. and Baiee, W. R. (2020) analysed the spatial crime and predicted the spatio-temporal hotspot in Baltimore city; Achu Ashok and Suja Rose (2016) to identify clustering pattern of murder, robbery, snatching and theft crime through spatial autocorrelation; Rogerson, P., and Sun, Y. (2001) to analysis the spatial pattern of crime changes over time; Ackerman, W. V., and Murray, A. T. (2004) studied the theoretical and applied approaches for location of crime and their reasons; Ahmed, M., et. al. (2013) examined the spatial distribution of police station according to population; Ratcliffe, J. H., and McCullagh, M. J. (1999) studied the crime analysis and identification of hotspots; Anselin, L. et. al. (2000) analysed the spatial statistical analyses of crime data and relationship between crime and place; Shukla, S. et. al. (2020) crime analysis and prevention is a systematic approach for identifying and analysing of patterns and trends in crime; Rahmani, M. H (2014) studied the types of land use and their relationship with crime occurrences; Mushtaq, S., and Omer, S.(2010) identified and demarcate hotspot of crime, displacement of crime and illustrating the relationship between the mapped crime pattern and geographic characteristics of the place. Therefore, this study intends to help the police administration of the city to have proper knowledge of the occurrence of major crimes- police station – wise to develop a design and implement web-based crime mapping in future.

STUDY AREA

Tiruchirappalli city's base map had been framed from the Survey of India (SOI) Toposheets Nos. 58 J/9, 10, 13 and 14. The city lies between the latitudes 10° 43' 40"- 10° 53' 00" North and the longitudes 78° 38' 14" - 78° 48' 50" East (Fig. 1). It covers an area of 167.23 sq. km with 60 wards and four Administrative Zones namely Srirangam, Ariyamangalam, Golden Rock and Abishekapuram (Fig. 2).
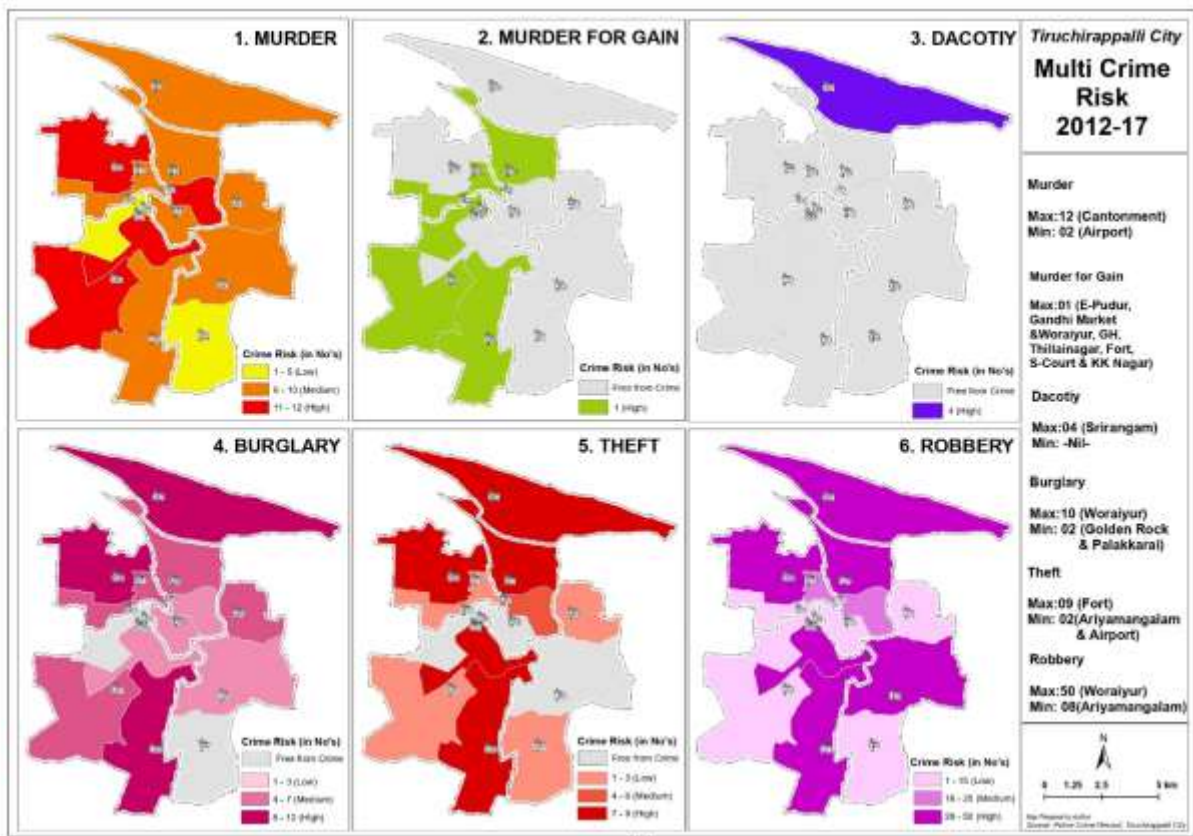
Fig. 1 LOCATION OF THE STUDY AREA

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Fig 2
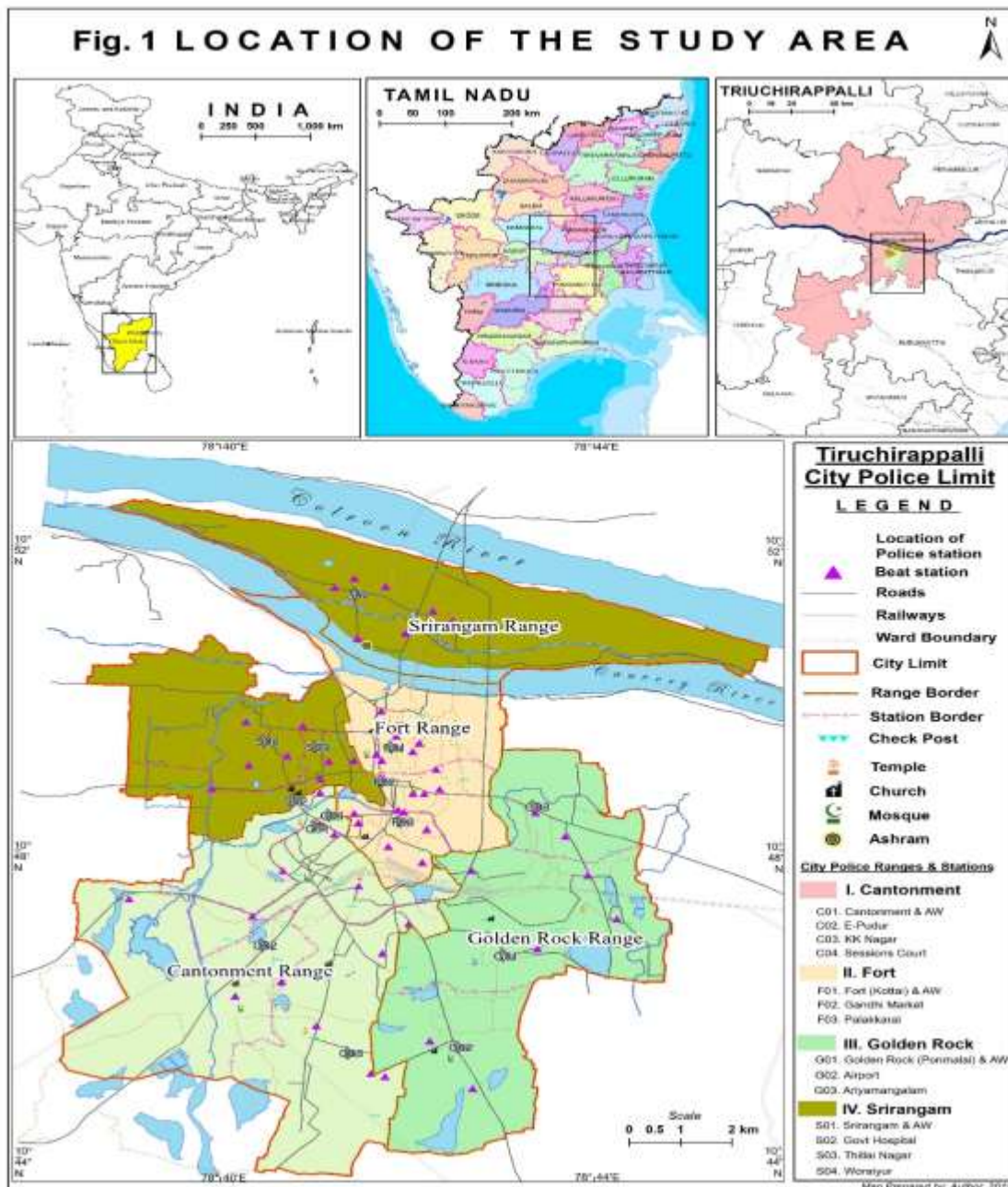
The topography of the city is relatively flat and its average elevation is 88 metres from mean sea level. Rockfort is the topmost hillock, it formed nearly 3,800 million years ago and it is marked as one of the ancient rocks in the world. The river Cauvery and its distributary Kollidam facilitate Tiruchirappalli city also the city is fertilised by the Uyyakondan, Kudamuritti and Koraiyar canals. The land closely adjoining the Cauvery River, which crosses the city from west to east, consists of fertile alluvial soil deposits on which crops like paddy, banana and sugarcane are cultivated and in dry soil, finger millet and maize are cultivated nearby.

The Commissioner of Police is divided into four ranges namely Cantonment Range, Golden Rock Range, Fort Range and Srirangam Range. The jurisdiction of Commissioner of Police System has not been extended to cover the newly expanded areas. Since the entire study depends on data from Commissioner of Police Office and 18 police stations including four AWPS, the study area has been restricted only to the geographical boundary of the city before expansion.

METHODOLOGY

The present study is based on secondary data sources. The crimes, which have been identified and registered in the FIRs of police stations, were collected from the City Crime Records Bureau (CCRB) Tiruchirappalli City Commissioner of Police Office, for the years 2012 to 2017. Only those major crimes (murder, murder for gain, dacoity, robbery, burglary and theft) a total of 560 classified by CCRB have been incorporated in the analysis to derive reliable crime rates through thematic maps by using Geoinformatics.

RESULT AND DISCUSSION

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Police Station -Wise Analysis of Major Crimes in Cantonment Range

The maximum rate of murder had been registered in Cantonment police station with 35.3% followed by Edamalaipattipudur police station with 32.4% and the minimum rate of murder had been registered in Sessions Court police station with 14.7% (Table 1).

Table-1 Police Station – Wise Major Crimes in Cantonment Range - 2012 – 2017

Name of the Range	Name of the police Station	Murder		Murder for Gain		Dacoity		Burglary		Theft		Robbery	
		Crime – Wise Total with %											
Cantonment	Cantonment	12	35.3	0	0.0	0	0	3	20.0	7	41.2	28	31.1
	Sessions Court	5	14.7	1	33.3	0	0	0	0	0	0	11	12.2
	Edamalaipattipudur	11	32.4	1	33.3	0	0	4	26.7	3	17.6	13	14.2
	K.K. Nagar	6	17.6	1	33.3	0	0	8	53.3	7	41.2	38	42.0
	AWPS Cantonment	0	0.0	0	0.0	0	0	0	0	0	0	0	0
	Total	34	100	3	100	0	0	15	100	17	100	90	100

The maximum murder for gain was recorded in Sessions Court, Edamalaipattipudur and K.K. Nagar police stations with 33.3%, while Cantonment police station and AWPS Cantonment did not record the crime murder for gain. The city was free from dacoity because this crime had not been recorded in any of the police stations of this range from the year 2012 to 2017 (Fig. 2). The highest rate of burglary had been recorded in K.K. Nagar police station with 53.3% and the lowest was in Cantonment police station with 20.0%. Sessions Court police station and AWPS Cantonment of this range did not record the crime burglary. The maximum rate of theft had been recorded in Cantonment and K.K. Nagar police stations with 41.2%, Edamalaipattipudur police station the was lowest with 17.6% and Sessions Court police station and AWPS Cantonment with 0.0%. The highest rate of robbery had been registered in K. K. Nagar police station with 42.2% and the lowest in Sessions Court police station with 12.2% and AWPS Cantonment recorded nil.

Police Station -Wise Analysis of Major Crimes in Golden Rock Range

The murder had been registered the highest crime in Golden Rock police station with 47.1% followed by Ariyamangalam police station with 35.3% (Table 2) and the lowest in AWPS Golden Rock with 5.9%. From 2012 to 2017, this range did not suffer from the crimes, like murder for gain and dacoity because these crimes were not reported in any of the police stations of this range. The burglary had been recorded in Ariyamangalam police station with 75%, and Airport police station and AWPS Golden Rock reported nil crimes of burglary. The highest rate of theft had been recorded in Airport and Ariyamangalam police stations with 50%, and Golden Rock police station and AWPS Golden Rock recorded nil. The robbery had been recorded the highest in Golden Rock police station with 56.2%, and the lowest in Ariyamangalam police station with 16.7% and robbery recorded in AWPS Golden Rock was nil.

Table-2 Police Station – Wise Major Crimes in Golden Rock Range - 2012 – 2017

Name of	Name of the police Station	Murder	Murder for	Dacoity	Burgla ry	Theft	Robber y

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		Crime – Wise Total with %									
Golden Rock	**Golden Rock**	8	47.1	0	0	0	0	2	25	0	0	27	56.2
	Airport	2	11.8	0	0	0	0	0	0	2	50	13	27.1
	Ariyamangalam	6	35.3	0	0	0	0	6	75	2	50	8	16.7
	AWPS Golden Rock	1	5.9	0	0	0	0	0	0	0	0	0	0
	Total	17	100	0	0	0	0	8	100	4	100	48	100

Police Station -Wise Analysis of Major Crimes in Fort Range

The maximum rate of murder had been recorded in Gandhi Market police station with 44.0% followed by Fort police station with 32.0% and the minimum had been registered in Palakkarai police station with 24.0% (Table 3). The maximum rate of murder for gain was recorded in Fort with 100% while other police stations like Palakkarai, Gandhi Market and AWPS Fort did not experience the crime of murder for gain. The city was free from dacoity because dacoity had not been recorded in any of the police stations of this range from the year 2012 to 2017. The burglary had been recorded in Fort police station with 44.4% followed by Gandhi Market police station with 33.3%, Palakkarai police station was the lowest with 22.2%, and AWPS Fort reported nil in crimes of burglary. The highest rate of theft had been recorded in Fort police station with 69.2% and the lowest was recorded in Gandhi Market police station with 30.8%, and Palakkarai and AWPS Fort recorded nil. The robbery had been registered the maximum in Fort police station with 50.0% and the minimum in Palakkarai police station with 20.4% and AWPS Fort reported nil in crimes of robbery.

Table-3 Police Station – Wise Major Crimes in Fort Range - 2012 – 2017

Name of the Range	Name of the police Station	Murder		Murder for Gain		Dacoity		Burglary		Theft		Robbery	
		Crime – Wise Total with %											
Fort	**Fort**	8	32.0	1	100	0	0	4	44.4	9	69.2	27	50
	Palakkarai	6	24.0	0	0	0	0	2	22.2	0	0.0	11	20.4
	Gandhi Market	11	44.0	0	0	0	0	3	33.3	4	30.8	16	29.6
	AWPS Fort	0	0.0	0	0	0	0	0	0.0	0	0.0	0	0
	Total	25	100	1	100	0	0	9	100	13	100	54	100

Police Station -Wise Analysis of Major Crimes in Srirangam Range

The maximum rate of murder had been registered in Woraiyur police station with 30.6% followed by Government Hospital police station with 27.8%, Thillainagar police station with 22.2% and the minimum had been registered in Srirangam police station with 19.4% (Table 4). The crime of murder for gain was recorded maximum in Thillainagar and Government Hospital with 50%, and other police stations Srirangam, Woraiyur, AWPS Srirangam did not experience the crime of murder for gain. Srirangam was the only police station, which recorded 100% dacoity, while other police stations Thillainagar, Woraiyur, Government Hospital and AWPS Srirangam were free from the crime of dacoity during the study period. 33.3% burglaries had been recorded in Woraiyur police station followed by Srirangam police station with

26.7%, Thillainagar and Government Hospital police stations had the same 20.0% and AWPS Srirangam reported nil crimes in burglary. The highest rate of theft had been recorded in Woraiyur police station with 38.1% followed by Srirangam with 33.3%, the lowest was recorded in Thillainagar and Government Hospital police stations with the same 14.3% and AWPS Srirangam had nil. The robbery had been registered the highest in Woraiyur police station with 38.8%, followed by Srirangam with 32.6%, the lowest was recorded in Government Hospital police station with 11.6% and AWPS Srirangam reported nil in crimes of robbery.

Table-4 Police Station – Wise Major Crimes in Srirangam Range - 2012 – 2017

Name of the Range	Name of the police Station	Murder		Murder for Gain		Dacoity		Burglary		Theft		Robbery	
		Crime – Wise Total with %											
Srirangam	Srirangam	7	19.4	0	0	4	100	8	26.7	7	33.3	42	32.6
	Thillainagar	8	22.2	1	50	0	0	6	20.0	3	14.3	22	17.1
	Woraiyur	11	30.6	0	0	0	0	10	33.3	8	38.1	50	38.8
	Government Hospital	10	27.8	1	50	0	0	6	20.0	3	14.3	15	11.6
	AWPS Srirangam	0	0.0	0	0	0	0	0	0.0	0	0.0	0	0.0
	Total	36	100	2	100	4	100	30	100	21	100	129	100

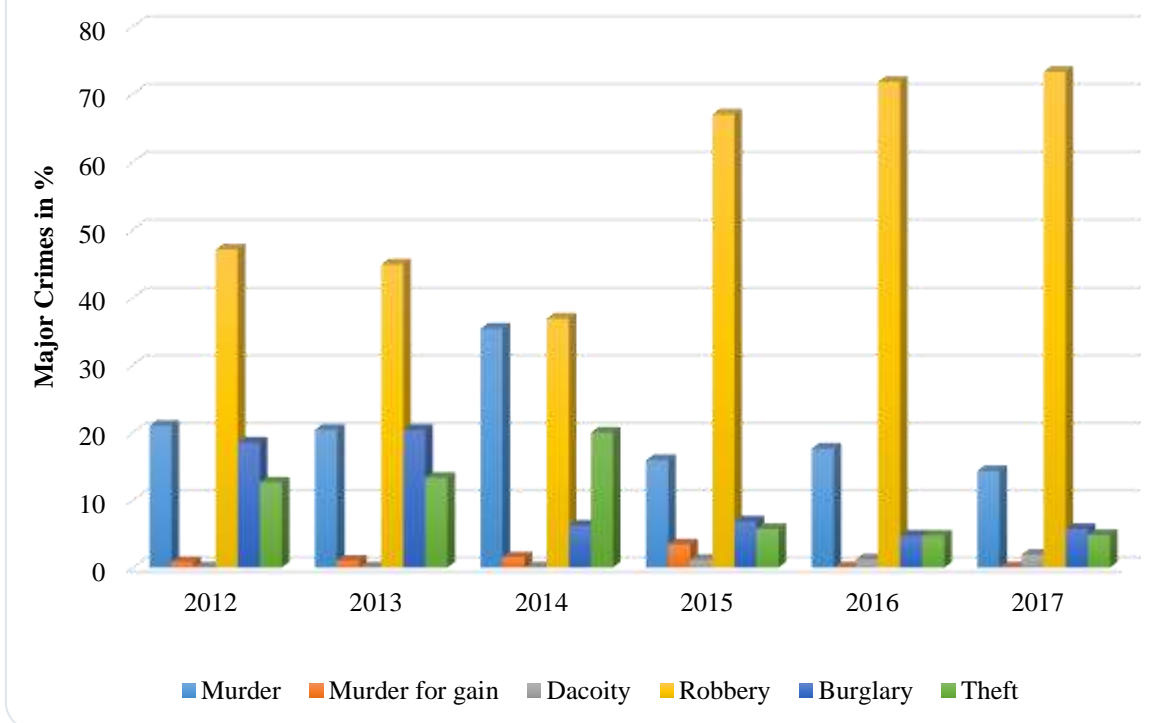**Analysis of Major Crimes within the Police Stations (Crime & Year-Wise)**

Police station- wise each major crime was compared with the total of the same crime reported in all the police stations, accordingly, Cantonment police station reported the highest rate of **murder** with 10.7% followed by Gandhi Market, Edamalaipattipudur and Woraiyur police stations with 9.8% and the lowest was reported in AWPS Golden Rock with 0.9% (Table 5). The maximum number of murders recorded in Edamalaipattipudur and Government Hospital police stations in the year 2012 and 2014 respectively (Fig. 3 & 4). A remarkable decline of murder was noted from 2012 to 2017. When comparing all the police stations within the ranges, the crime murder was recorded the maximum in Srirangam range (32.1%) and the minimum in Golden Rock range (15.2%) (Fig. 5).

Table -5 Police Stations Wise Major Crimes with all the Ranges -2012-2017

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Ranges	Police Stations	Murder		Murder for Gain		Dacoity		Burglary		Theft		Robbery		Total	%
		Crime – Wise Total with %													
Cantonment	Cantonment	12	10.7	0	0.0	0	0	3	4.8	7	12.7	28	8.7	50	8.9
	Sessions Court	5	4.5	1	16.7	0	0	0	0.0	0	0.0	11	3.4	17	3.0
	Edamalaipattipudur	11	9.8	1	16.7	0	0	4	6.5	3	5.5	13	4.0	32	5.7
	K.K. Nagar	6	5.4	1	16.7	0	0	8	12.9	7	12.7	38	11.8	60	10.7
	AWPS Cantonment	0	0.0	0	0.0	0	0	0	0.0	0	0.0	0	0.0	0	0
Golden Rock	Golden Rock	8	7.1	0	0.0	0	0.0	2	3.2	0	0.0	27	8.4	37	6.6
	Airport	2	1.8	0	0.0	0	0.0	0	0.0	2	3.6	13	4.0	17	3.0
	Ariyamangalam	6	5.4	0	0.0	0	0.0	6	9.7	2	3.6	8	2.5	22	3.9
	AWPS Golden Rock	1	0.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2
Fort	Fort	8	7.1	1	16.7	0	0.0	4	6.5	9	16.4	27	8.4	49	8.8
	Palakkarai	6	5.4	0	0.0	0	0.0	2	3.2	0	0.0	11	3.4	19	3.4
	Gandhi Market	11	9.8	0	0.0	0	0.0	3	4.8	4	7.3	16	5.0	34	6.1
	AWPS Fort	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0
Srirangam	Srirangam	7	6.3	0	0.0	4	100	8	12.9	7	12.7	42	13.1	68	12.1
	Thillainagar	8	7.1	1	16.7	0	0.0	6	9.7	3	5.5	22	6.9	40	7.1
	Woraiyur	11	9.8	0	0.0	0	0.0	10	16.1	8	14.5	50	15.6	79	14.1
	Government	10	8.9	1	16.	0	0.0	6	9.7	3	5.5	15	4.7	35	6.3

Hospital				7										
AWPS Srirangam	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**0**	**0**
Total	**112**	**20.0**	**6**	**1.1**	**4**	**0.7**	**62**	**11.1**	**55**	**9.8**	**321**	**57.3**	**560**	**100**

Fig. 3 Major Crimes in Tiruchirappalli City

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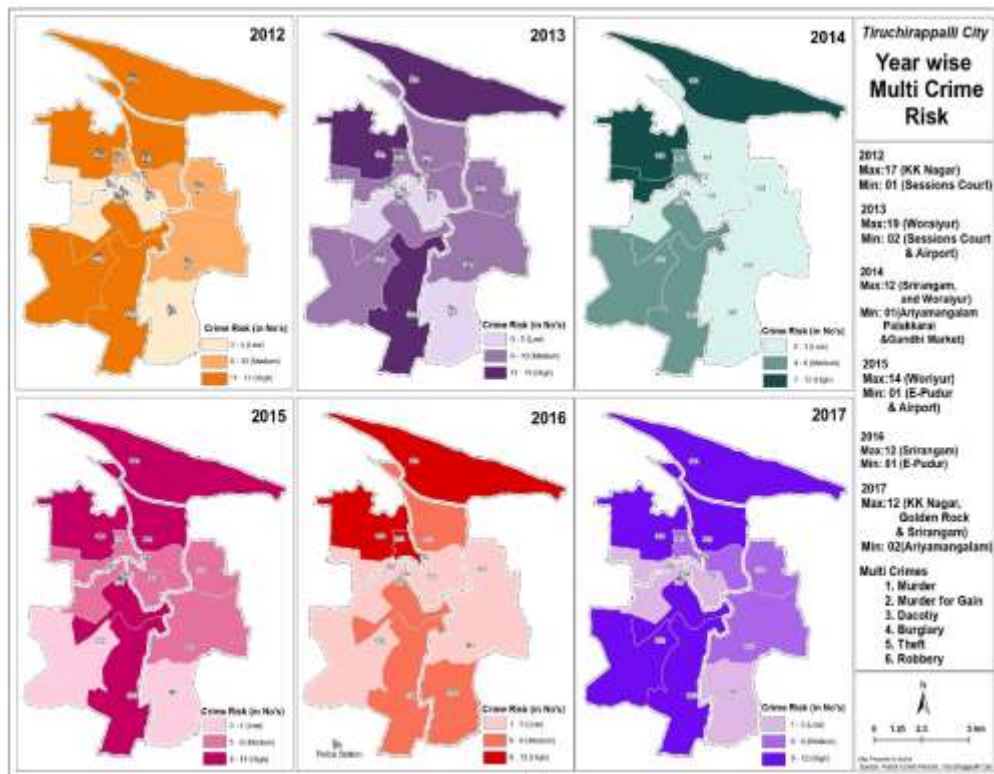
Fig. 4

Murder for gain was reported in Sessions Court, K. K. Nagar, Edamalaipattipudur, Thillainagar, Government Hospital and Fort police stations with 16.7%. The crime of murder for gain was not reported in the rest of the police stations. The maximum number of murders for gain was registered in 2012, 2013, 2014 and 2015. When looking at all the police stations within the ranges, Cantonment range experienced the maximum crimes with 50% and the minimum was Fort range with 16.7%. The city was almost free from the crime of murder for gain.

Fig. 5 Range & Crime - Wise Major Cirme in Tiruchirappalli City
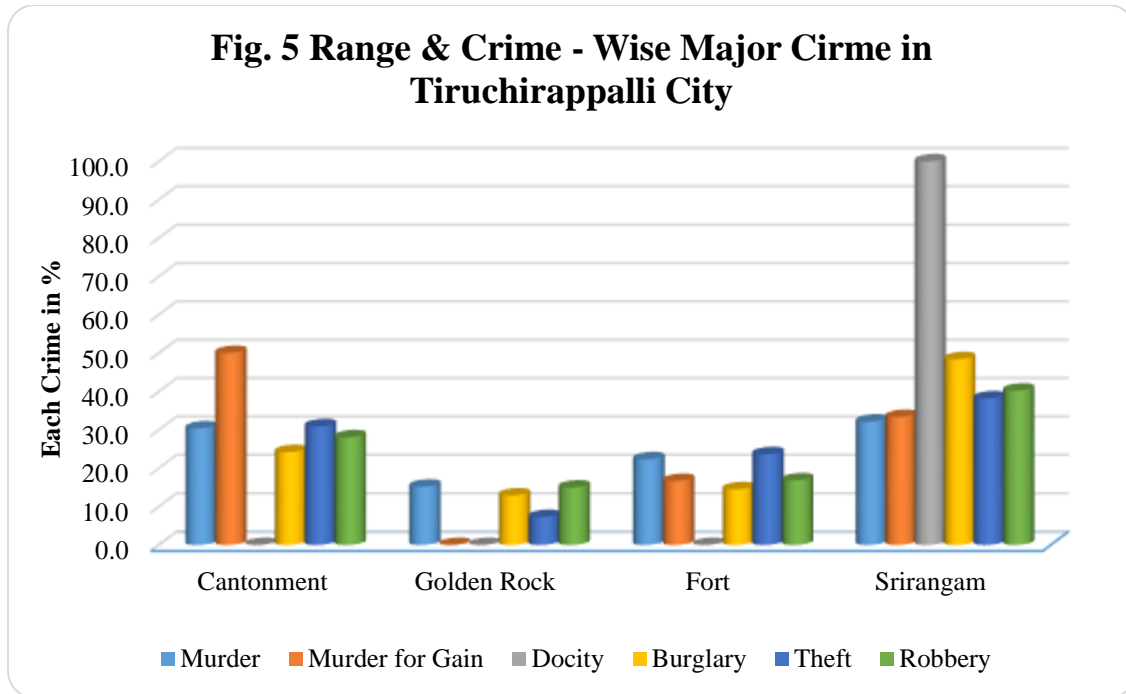
Dacoity crime was reported only in Srirangam range of Srirangam police station from 2015 to 2017. The maximum number of dacoities was registered in the year 2017 in Srirangam police station. An increase in the crime of dacoity was observed in Srirangam police station only.

Woraiyur police station recorded the maximum of **burglary** with 16.1% followed by Srirangam and K.K. Nagar police stations with 12.9% and Ariyamangalam, Thillainagar and Government Hospital police stations with 9.0 %. The lowest was reported in Golden Rock and Palakkarai police stations with 3.2% while Sessions Court and Airport police stations recorded nil crimes of burglary. The maximum number of burglaries was reported in the year 2013 in Woraiyur police station. Range-wise, Srirangam range (48.4%) ranks first and Golden Rock range (12.9%) ranks last in this crime. A remarkable decline in the crime of burglary was observed from 2012 to 2017.

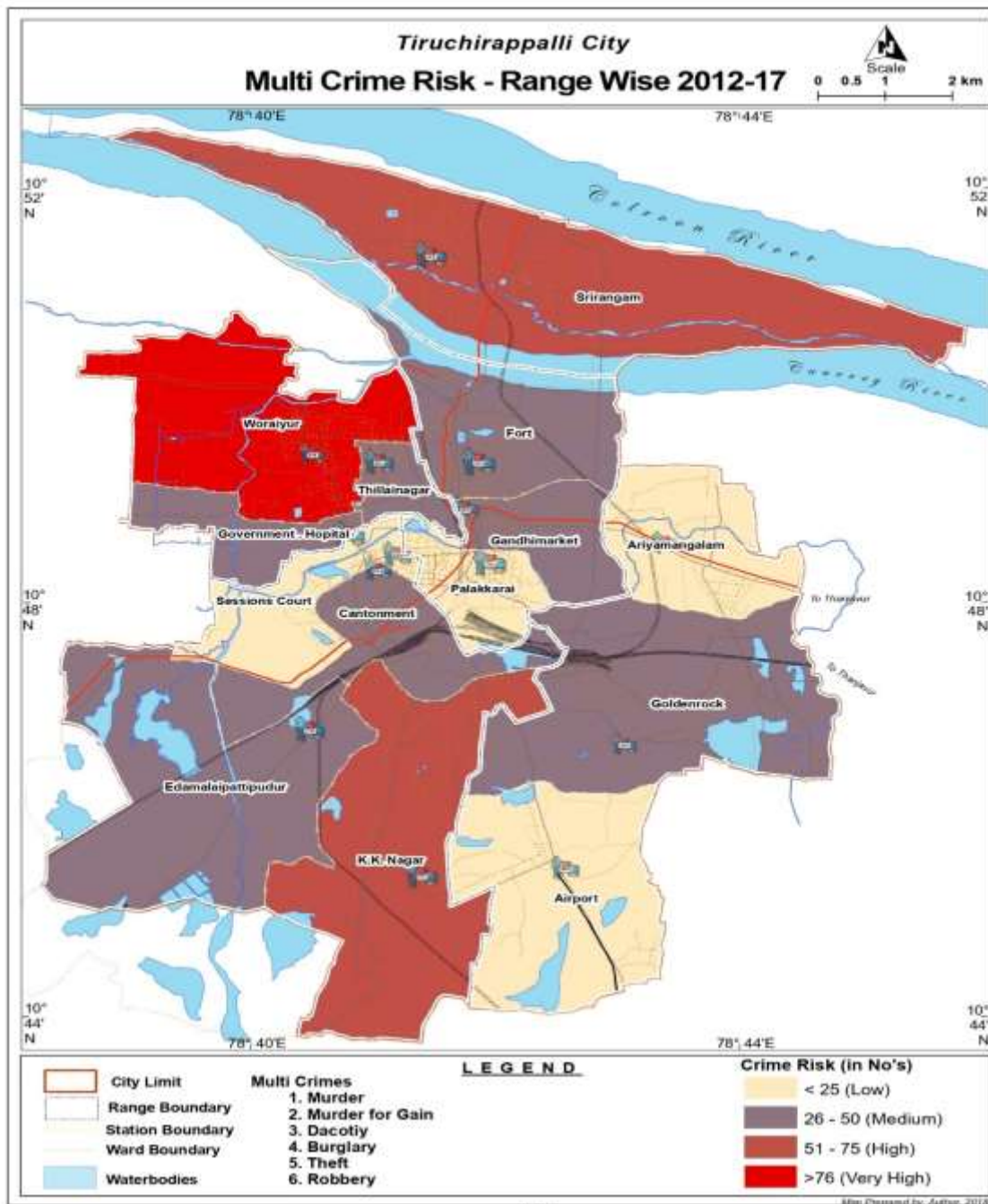P. Mary Santhi*, S. Balaselvakumar*, K. Kumaraswamy**

Fig. 6

Maximum **theft** was recorded in Fort police station with 16.4% followed by Woraiyur and Srirangam police stations with 14.5% and 12.7% and the lowest was recorded in Airport and Ariyamangalam police stations with 3.6%. Sessions Court, Golden Rock and Palakkarai police stations did not record the crime of theft. The maximum number of thefts was reported in the years 2012, 2013 and 2014 in Cantonment, K.K. Nagar, Fort, and Woraiyur police stations. When taking a gander at all the police stations within the ranges, Srirangam range experienced the maximum crimes with 38.2% and Golden Rock

range with 7.3% was the minimum. A remarkable decline in the crime of theft was noted from 2012 to 2017.

Fig. 7 Range & Year-Wise Major Crimes in Tiruchirappalli City
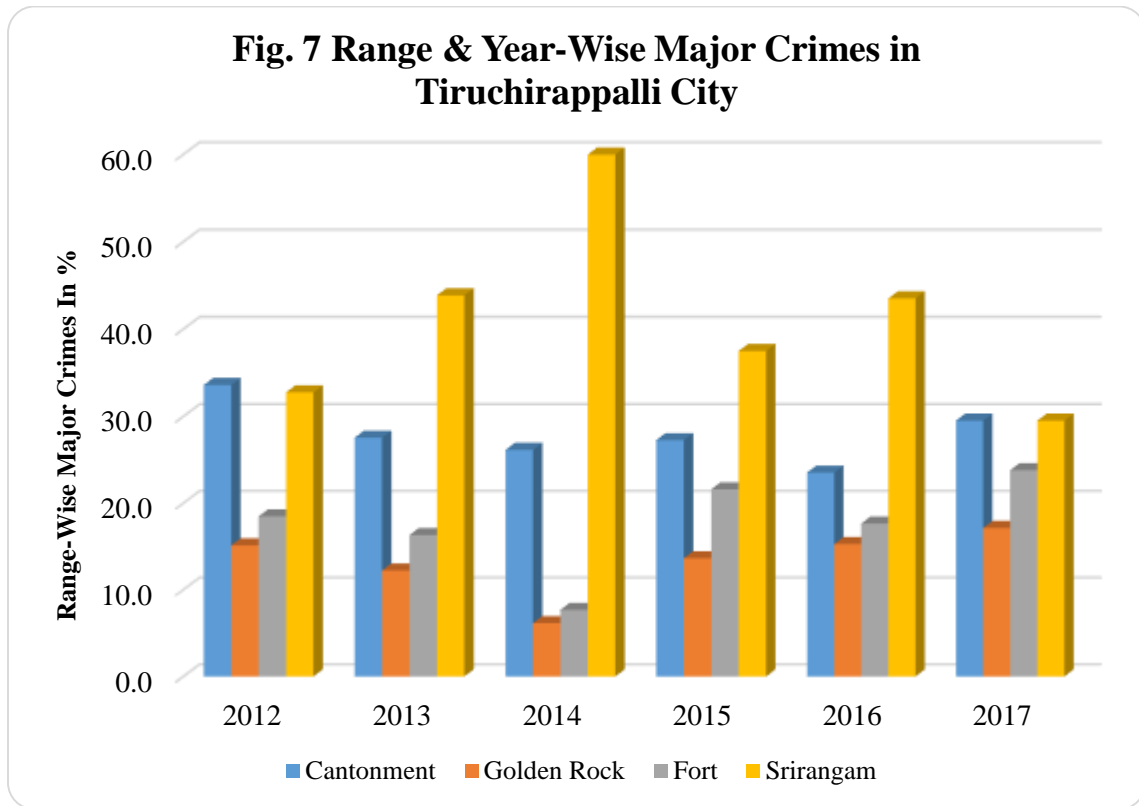
Woraiyur police station reported the highest rate of **robbery** with 15.6% followed by Srirangam police station with 13.1% and the lowest was reported in Ariyamangalam police station with 2.5%. The maximum number of robberies was reported in the years 2015 and 2017 in K.K. Nagar, Golden Rock and Woraiyur police stations. When associating all the police stations within the ranges, Srirangam range experienced the maximum crimes with 40.2% and Golden Rock range was the minimum with 15%. In general, an increase in the robbery was observed during the period of study.

Conclusion

Major crimes were mostly reported in Woraiyur and Srirangam police stations which is 14.1 and 12.1 %. The maximum of robbery (57.3%) and a minimum of murder for gain (1.1%) and dacoity (0.7%) crimes were recorded in the city (Table 5). The maximum (60.0%) of major crimes were recorded in all the police stations of Srirangam range and a minimum (6.2%) was recorded in all the police stations of Golden Rock range in 2014 (Fig. 6). Hence, it is concluded that the spatial distribution and variation of the major crime police station-wise, was high in Srirangam range (39.6%) and low in Golden Rock range (13.8%) (Fig.7). Therefore, it is suggested that the number of police stations and their force to be increased in proportion to the population along with high-end security system in the northern part of the city of Srirangam range especially in Woraiyur, the central part of Gandhi Market in Fort range and southwest of Cantonment in Cantonment range and also in the sensitive areas of - Varanganeri, Tharanallur, Khajapettai, Uppuparai, Mettutheru, Pullakutta Theru, Eda Kulumikarai, TVS Tolgate, Keelachinthamani, Gandhi Market, Marakkadai, Karumandapam, Tharanallur, Beema Nagar and Periyakammala Street.

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The spatial patterns of crime maps of the city must be prepared periodically and systematically so that the police officials are in a better position to know the crime-prone areas, their growth, location, direction and their trend and patterns and they should also closely work with intelligent groups of the department. The police department should also apply photography, body scanners, Global Positioning System (GPS), Visual Positioning System (VPS) with the alarm system and Drone camera, advanced CCTVs consisting of microphones to record the audio along with video cameras, to capture images/video of people's moves and actions especially on Thursdays and Saturdays of temple festival of Srirangam and other crime-prone areas.

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