Towards E-Government's 3D Property

Abstract-This paper provides an introduction into the 3D property type in Malaysia. It provides a brief introduction on Malaysia as a country then be followed by an explanation on the land administration and cadastral system. This paper discusses literature on good governance and e-government. It continues with the discussion on e-government in Malaysia, which consists of e-Land, e-Cadastre which is part of Coordinated Cadastral System, Virtual Survey System and Cadastral Data Integrity System as well as the Electronic Strata Module that consists of Strata Lodgement Module, Electronic Strata Survey Module and Strata Verification Module before end with the conclusion. Through this paper, we understand the government activities on cadastre system in Malaysia.

Index Terms- Land, Administration, Registration, E-cadastre, E-land, Governance, Coordinated Cadastral System

1 Introduction

In Malaysia, there is a lack of proper legislation regarding 3D property in land and cadastral law to cater for the registration of any related legal and technical aspects. Many conflicts seem to exist between laws and statutes with the current cadastral status. Therefore, the rights associated with this registration should be clear in the registry titles issued. As a result of this, perhaps better 3D visualization should be developed and employed.

Firstly, Strata Title Act 1985 (Act 318) allows land to be subdivided into parcels or land parcels based on the area occupied. Secondly, National Land Code 1965 (Act 56) allows air space rights above ground surface up to a maximum of 21 years in form ranging from an absolute conveyance to splitting off individual rights associated with the air space parcel.

There are currently many arguments about the surface under different categories of land use, subdivision, partition and amalgamation. These arguments would evidently be different if 3D property rights are used. Without the possibility of using 3D properties, other legal rights have to be used to allow separate parties to use different parts of one building or property. Such rights invoked include easements, common property, joint property or joint ownership with an individual right to use a specific part. However, each of these forms has certain disadvantages and limitations. The need for numerous uses of space and access to three dimensionally defined spaces in general is not resolved satisfactorily with only the traditional definition of property, thus calling for the introduction of ownership rights to three dimensionally defined spaces.

2 Malaysia Country Information Background

The Federation of Malaya is formed in 31st August 1957 with 11 states, six years later Sabah, Sarawak and Singapore joined the federation in 16th September 1963 and Malaysia is formed as a federation of fourteen states in Southeast Asia. However, in 9th August 1965, Singapore declared its independence from Malaysia. Now, the country covers an area of about 329,758km^2 in land and water spaces while the marine spaces within Malaysia's jurisdiction are about 515,000km^2 and a coastline of approximately 4576km in length (Nordin, 2001).

The country consists of two geographical regions separated by the 1,074 kilometres wide South China Sea. West Malaysia also known as Peninsular Malaysia consists of eleven states (Johore, Kedah, Kelantan, Malacca, Negeri Sembilan, Pahang, Penang, Perak, Perlis, Selangor and Terengganu) and two federal territories (Kuala Lumpur as the capital, and Putrajaya as the federal administrative centre) while East Malaysia consists of two states (Sabah and Sarawak) and federal territory of Labuan.

3 Malaysian Cadastral System

Peninsular Malaysia is a federation of states, each of which is responsible for its own land matters. All States operate a Torrens system of registration, administered by the State Land Offices and coordinated by the Department of Land and Mines. On the other hand, cadastral surveys are controlled by the Department of Survey and Mapping Malaysia that is a federal department. Department of Survey and Mapping Malaysia is responsible for cadastral survey work within Peninsular Malaysia but is supported by a growing number of licensed land surveyors, who are primarily responsible for engineering and subdivision surveys. Notwithstanding the above, the cadastre in the states of Sabah and Sarawak are administered by the Department of Land and Surveys. They have the ideal set up of having land administration and cadastral surveys under the control of a single organization, which is a state entity.

The objectives of the Malaysian Cadastral System are to provide security and simplicity to all dealings with land. It establishes and certifies, under the authority of the government, the ownership of an indefeasible title to land and simplifies, hastens and reduces the costs of all land dealings. The title is a conclusive proof that the person mentioned therein is the owner of the land described therein. Valid titles require an accurate description of boundaries and as such, cadastral survey plays an important role in the system.

The Malaysian Cadastral System has essentially two basic components, namely land registration and the cadastral survey. The most important element in the land registration

component is the type of title called system of land tenure and the nature of government guarantee. The system provides for registration to confer indefeasible title or interest, except in certain circumstances, such as through fraud or misrepresentation or registration obtained by forgery or by means of an insufficient or void instrument.

The Malaysian Cadastral System provides for textual and spatial information that is consistent with the two aforementioned components of the system. Although not strictly part of the cadastral system, valuation, local government and planning authorities are heavily reliant on the cadastral system. They utilize the information provided by the system in the conduct of their businesses and work in close coordination with the institutions supporting the system.

Malaysian cadastral mapping is based on the Cassini Solder Coordinate System. Each state has its own origin and reference meridian. Cadastral maps are used primarily for identification of land parcels for the purpose of land management. All the lots that are surveyed by both government and licensed land surveyors are plotted on this map.

4 Towards 3D Property Formation

Lately, the development of 3D cadastre registration are more on the technical part where researchers study on the process of adding 3D cadastre objects in the current cadastre data model and information, accessible amongst the Department of Survey and Mapping Malaysia, State Land and Mines Office and District Land Office. Unfortunately, the two stated database, which are Cadastral Data Management System (CDMS) and Computerized Land Registration System (CLRS) database works separately in different authorities and is still not in three-dimensional situation. As mentioned in this research previously, Malaysian Land Administration is based on the Torrens System where Cadastral Map and Document of Title with spatial and textual information as legal evidence are required under the rules and regulations in order to have full institutional coordination. Therefore, a good institution is very important in order to achieve an excellent and wonderful cadastre registration system. However, due to historical constraints, it seems quite difficult to realize this unless with full cooperation from various legal bodies, technical organizations and other land related governments and private sectors.

Recently, with the advanced of technology, the development of 3D cadastre proposed a registration model focused on the combination of these two different databases mentioned above and these two cadastre registration databases namely the legal rights, land attributes and the spatial objects geo-data. These three authorities mentioned above, are the main government agencies that are responsible for the cadastre registration system where they integrate and coordinate each other, in order to have an integrated and comprehensive cadastral system in Malaysia by using the 2D/3D hybrid cadastre approach [1].

The 3D cadastre objects such as stratified buildings, construction above and below the ground surface are the responsibility of the Department of Survey and Mapping Malaysia, State Land and Mines Office and District Land Office on the ownership registration and object registration respectively. In short, 3D cadastre registration is a combination of land registration with plan land parcel and three-dimensional land parcel of cadastral registration. These are combinations of legal rights of land attributes, plane cadastral objects and three-dimensional information.

5 Malaysian Land Administration

Malaysian Land Administration is traditionally based on Malaysian land law while cadastral system in Malaysia consists of land registration system and cadastral survey and mapping registration system that have different structures and authorizations. In brief, land administration in Malaysia is generally responsible for the collection of revenue, title registration, managing application for land dealings, changing of condition of land use, subdivision, partition or amalgamation of land or building and so on. The land registration is a state government juridical while cadastral survey and mapping is under federal jurisdiction. It provides a variety of rights depending on the traditions of the country, but the legalistic cadastral system and land law are still using plane geometric expression for land and property tenure. They have not been prepared to register in three-dimensional situations.

Land use rights are one of the rights that are often based on occupation of land over a long period and can be defined in written law or by traditions [2]. Hence, a systematic record of lands in all matter is very important in the land administration, planning and development of land. This means that, due to the ever increasing demand for ground space, the traditional paradigm in law should be changed [3].

5.1 The Development of Land Tenure and Land Law Systems

According to [4], land law provides a variety of rights, depending on the traditions of the country while land use rights are one of the rights that are often based on occupation of land over a long period and can be defined in written law or by traditions. In addition, according to [5], there are four major sources of national land law, on chronological order that include Malay Customary Law (*Undang-undang Adat Melayu*), Islamic Law (*Undang-undang Islam*), English Law (*Undang-undang Inggeris*), and National Land Code 1965 (Act 56) (*Kanun Tanah Negara*).

5.2 System before National Land Code 1965 (Act 56)

The customary land tenure in Peninsular Malaya, prior to British occupation of Malacca, was exercised by the British to effectively protect its control over the Malay states. They followed the same pattern as in Sumatra, Java, Sarawak, Borneo, Burma, Siam and parts of India and Ceylon. When it

was given to the English, Penang was virtually an uninhabited island with no settled law, much less a recognized land system. Historical records showed that before the arrival of the English traders in 1786, the year that Ruler of Kedah ceded the Penang Island to the East India Company, there was not any English Laws been established in Penang. In other words, before the arrival of the English traders, the Peninsular Malaya was already governed by Islamic Law and Malay Customary Law. It can be seen from some historical records that laws existed such as Malacca Laws of 1523, the Pahang Laws of 1596, the Kedah Laws of 1605, the Johore Laws of 1789, the Perak Code and the Ninety Nine Laws of Perak 1765 [6]; [7]. Besides, the Malay states were never ceded by the British, so, there is no question of English Law or the Deeds System been introduced into the Malay states before the Malay states accepted British protection. The only law at that time applicable to the Malay was Mohammedan Law modified by local custom.

The early English Law that was introduced into Penang was known as the Deeds System, which recorded land transactions in the form of deeds or indentures. According to [7], the Deeds System was introduced in Penang properly as early as 1807 and in Singapore in 1819, later extended to Malacca in 1826. The land law in Penang remained the same with Deeds System even after the Torrens System was introduced in the Malay states until 31st December 1965. However, Malacca was different from Penang. Prior to the arrival of the English, Malacca had a long history of self-rule under the Malay Sultanates before being occupied by the Portuguese, Dutch and English. Therefore, the Malacca land tenure system was a combination of traditional Malay Customary Law, Islamic Law, Portuguese and Dutch Laws. The Malay Customary Tenure endured and continued influentially in Malacca until the late 1886 when the English Deeds System became fully implemented. As was the case in Penang, the Deeds System lasted in Malacca until the passing of the National Land Code (Penang and Malacca Titles) Act 1963 which came into force simultaneously with the National Land Code 1965 (Act 56) on 1st January 1966.

The introduction of Torrens System in the four (4) States after they are united in 1896 and formed the Federated Malay States, which are Pahang in 1887, Perak, Negeri Sembilan and Selangor in 1874 when they have accepted the Residency System. The first land tenure enactment, named General Code of Regulations Regarding land (Perak) was enacted on 28th February 1879, followed by Selangor General Land Regulations No. 2 of 1882, Negeri Sembilan Land Regulations of State Council Minutes on 8th April 1887 and Pahang General Land Regulations in 1889. The land tenure and enactment of the 1890s of each of the four Federated Malay States was repealed and re-enacted in 1903. Later, in 1911, the first united land enactment of the Federated Malay States were passed, named Land Enactment No. 11 of 1911 (Federated Malay States) and the Regulation of Titles Enactment No. 13 of 1911 (Federated Malay States). These two Federated Malay States enactment of 1911 remained in force until amended by the Land Code 1926 (Cap 138), affected on 1st January 1928 which unified the land law held on Registry Title and Mukim Registry until it was repealed by the National Land Code 1965 (Act 56) on 1st January 1966.

In conclusion, the amending, repealing and replacing of such land laws, ordinances, codes, rules and regulations throughout the period for this land tenure system is to suit the needs of modern economic development and the increased use of land on a commercial basis.

5.3 System after National Land Code 1965 (Act 56)

The National Land Code 1965 (Act 56) came into force in 1st January 1966 to administer all land matters in Peninsular Malaysia and Federal Territory of Labuan while Sabah and Sarawak still uses their own land ordinance. For Sabah, there are Sabah Land Ordinance 1930 (Cap. 69), Land (Subsidiary Title) Enactment 1972, and Land Acquisition Ordinance (Cap. 69) while for Sarawak, there are Sarawak Land Code 1958 (Cap. 81), Mining Ordinance 1985 (Cap. 83), Land Control of Subdivision Ordinance (Cap. 82), and Strata Title Ordinance 1957 (National Land Code, 1965).

6 Land Legislation Framework

Law and legislation are a complex set of rules that have been developed gradually and naturally within each society to ensure its orderly running and the peaceful behavior of its members. As [8] mentions that, there are statutory laws in which all rules and regulations are written down and codified. Customary law had no written record. But, the code was assumed to be well known by all members of the society. On the other hand, common law, which grew out of customary law, the judgment of the courts has been written down to create precedents where by new cases can be judged.

6.1 Land in Malaysian Legislation

In the Malaysian land registration, the process of recording rights in land is via registration of title of land. "Land is a state matters", according to Federal Constitution 1957, land matters is under the jurisdiction of state government, handled by the respective state Registry or District Land Office, depending on where the Document of Title was formerly registered.

Land Ownership as governed by the National Land Code 1965 (Act 56) is based on the Torrens System (see previous sections). It is protected by the National Land Code 1965 (Act 56) in Section 340 (Registration to confer indefeasible title or interest, except in certain circumstances) and is guaranteed by the Federal Constitution 1957 as stated under Article 13 (rights to property). Once an ownership is being registered, the owner's title and interest is indefeasible except when it involved fraud or misrepresentation. Furthermore, nobody shall be deprived of property unless he or she had been paid an adequate compensation.

Meanwhile, there are three ways to acquire land. Firstly, the land can be acquired through alienation from the state authority under Section 42 and Sections 76 to 78, National Land Code 1965 (Act 56), secondly is by dealings and finally

through inheritance. State agencies and the Federal Government are required to go through State Authority to acquire land in accordance with the Land Acquisition Act 1960 (Act 486) [9].

6.2 Rights and Powers of the Federation and State Authority

Section 6 of the National Land Code 1965 (Act 56) states the Director General of Land appointed under the Federal Commissioner Ordinance 1957 shall be known as the Director General of Lands and Mines. The Director General of Lands and Mines is delegated with the power from the Minister, may consult and correspond through meetings with State Directors, which requires them to furnish him/her with reports and information relating to land administration within the state as well as to enter and inspect the Land Registry or land Office records in any states with their approval.

Article 91 of the Federal Constitution 1957 provides for establishment of the National Land Council or better known as *Majlis Tanah Negara* (MTN) and it is usually chaired by the Prime Minister, a representative from each state, usually the Chief Minister or *Menteri Besar* and the maximum ten representatives from the federal government. The duty of the National Land Council is to formulate from time to time in consultation with the Federal and State Governments, and the National Finance Council on a national policy for the promotion and control of the utilization of land throughout the Federation. It is compulsory for both the federal and state governments to follow the policy formulated by the National Land Council [10].

On the other hand, Section 11 of National Land Code 1965 (Act 56) specifies that the State authority may be notified in the Gazette of the administrative areas by dividing it into district, *mukim*, town or village after it has been surveyed and declared by the State Director of Survey and Mapping. The state authority may appoint a State Director of Lands and Mines, a Registrar, a Director of Survey and Mapping, District Land Administrators and other officers that the State authority may consider necessary. Sections 40 to 42 of the National Land Code 1965 (Act 56) also points out that all state land, minerals and rock material within the territories of the state shall be vested solely in the state authority.

Furthermore, the State authority shall have power to alienate state land under Section 76 of National Land Code 1965 (Act 56), reserve state land and grant leases of reserved land under Sections 62-64 of National Land Code 1965 (Act 56), permit the occupation of state land, reserve land and mining land under temporary occupation licenses under Sections 70-75 of National Land Code 1965 (Act 56) and permit the use of air space on or above state land or reserved land where such air space shall be within the confines of a structure under Section 75A-75G of National Land Code 1965 (Act 56).

6.3 Cadastral Survey and Registration in Malaysia

All cadastral survey and registration are performed at the request of the Land Office on the issue of request for survey. The work of the Land Office is concerned with registration of title and with land alienation, either for individuals, government agencies, companies or groups. Meanwhile, the Federal Department of Director General of Lands and Mines (JKPTG) has a purely advisory role in State land matters staffed by servant administrators.

6.4 Cadastral Survey

The objectives of cadastral survey are primarily concerned with the determination of definition of property boundaries, locations and areas, through their marking and description on the ground and plans or maps respectively, for the purposes of alienation, subdivision, partition, amalgamation and conveyancing. The system as practiced is one of fixed and defined boundary whereby parcel definition is by the officially emplaced and mathematically coordinated boundary marks [3].

Before final survey of particular property, no registered title can be registered and issued as final until the cadastral survey has been completed and the final title prepared by the Survey Department or Licensed land Surveyor [11]. However, temporary land titles or better known as Qualified Titles may be issued on the basis of a rough survey. The purpose of issuing the Qualified Titles is to speed up land development so that, once planning approval has been obtained for any area, development can commence prior to the execution of precise surveys. This avoids the delay of development since the Qualified Titles allows financing by banks and investors.

It is here to assert that, Section 396 (1) of National Land Code 1965 (Act 56) specifies that, for the purpose of the act, land shall not be taken to have been surveyed until "(a) Its boundaries have been determined by right lines; (b) Its boundaries as so determined have been demarcated on the surface of the land by boundary marks or, if by reason of the configuration thereof or for any other cause the placing of boundary marks on the actual line of the boundary is to any extent impossible or impracticable, boundary marks have been so placed as to enable that line to be ascertained; (c) The area enclosed by its boundaries as so determined has been calculated; (d) A lot number has been assigned thereto by the Director of Survey; and (e) A certified plan, showing the situation of the land, the position of its boundaries as so determined and of the boundary marks placed thereon and the area and lot number thereof, has been approved by the Director of Survey" [12].

In general, in considering the huge volume of survey works by the government surveyors, the Licensed Land Surveyors Act 1958 (Act 458) and Regulations that are related to the licensing and control of private land surveyors, allowed private surveyors licensed by the Land Survey Board, that is Licensed Land Surveyor to practice their profession as a land surveyor and shall be authorized to carry out title surveys

[13]. This was to encourage a gradual transfer of responsibility for executing title surveys to private professional body to help the Department of Survey and Mapping Malaysia to carry out title surveys, and the Department of Survey and Mapping Malaysia retained its rights to control such activities [4].

6.5 Cadastral Registration

The traditional cadastral registration system that is practiced in Peninsular Malaysia is a parcel bound system and provides essential lands and properties information of the lots and land parcels [14]. The existing Malaysian cadastral survey and mapping registration system and land registration system, deals with properties not only located on the surface level, but above the surface level and also below the surface level. Therefore, the rights of the proprietor of the surface parcel shall also apply to the proprietor of the above that is air space and underground land as well.

The current Malaysian cadastral registration system does not include three-dimensional objects registration rights. This type of cadastral system has been practiced in Malaysia for a period of one hundred years and it provides essential information about land and property like ownerships of the lots and land parcels for the country. In addition, Cadastral Database Management System (CDMS) and Computerized Land Registration System (CLRS), which worked separately in each organization with different legal aspect, are still in plane surface nature. Consequently, there are no three-dimensional property rights as well as 3D cadastral rights. However, these two systems later on can be incorporated in the registration form with the present advanced and modern technologies such as Geographical Information System, internet, web based and e-commerce applications.

6.6 Integration of Cadastral Database Management System and Computerized Land Registration System

There could be extensive benefits if Computerized Land Registration System (CLRS) of State Land and Mines Office and District Land Office and Cadastral Database Management System (CDMS) of Department of Survey and Mapping Malaysia, are linked together [15]. Therefore, with the integration of attribute data from CLRS and spatial data from CDMS and through identified applications, efficiency of land administration can be greatly improved. According to [3], the envisaged applications include on-line registration for survey and preparation of title, extending Digital Cadastral Database enquiry module to the land administrators and on the other hand, linking the Qualified Title information to the Digital Cadastral Database. Although conceptually tenable, the eventual implementation would need substantial negotiation and compromise among State Land and Mines Office (PTG) and District Land Office (PTD) and Department of Survey and Mapping Malaysia (DSMM).

With the vast change in the Information and Communication Technologies (ICT), such as Geographical Information System, internet and web-based application and together with the initiative of Malaysian Geospatial Data Infrastructure (MyGDI) National Spatial Data Infrastructure (NSDI), e-Land of Ministry of Natural Resources and Environment (NRE) and e-Cadastre of DSMM, CLRS and CDMS database could be integrated electronically. In order to achieve the goal of comprehensive Land Information System from district level up to state level and eventually at the national level, the integration of spatial CDMS database with the textual CLRS database play a preliminary requirement of all these. Moreover, [16] introduced a mechanism to integrate these two standalone databases. He suggested that coordination among these authorities can be provided by the installation of centralized server or distributed server at each of their office that act as the transporters and bridges in exchanging data between CLRS and CDMS.

7 Good Governance of Land Administration

Good governance is one of the important issues in development of land administration system which affects the need for its information and accessibility. According to [17], the concept of governance is not only about government, it rather recognizes the power exists inside and outside the formal authority and government institutions (amongst the government, private sector and civil society).

In short, good governance is at the heart to good land administration. A successful land administration requires accountable, stable institutions, transparent and zero corruption government. On the other hand, weak governance in land administration can lead to massive over regulation, conflicting production as well as gap-ridden laws, standards and legal documents [18]. Therefore, a national capacity is vital to formulate and implement laws necessary in implementing good governance.

7.1 E-government

Since the twentieth century, land oriented infrastructures began to use all benefits of information and communication technologies to facilitate the processes of government and public administrations. These happened more rapidly especially during the twenty first century when the geographical information technology became more advanced and combined with the rapid growth of global information networks such as wider networks, mobile computing and the internet, making e-government widely known [19] whilst land oriented business is constantly evolving, looking for optimal solutions. In this regard, e-government has become a new emerging concept and an issue in all segments of land administration systems. Quite often, the meaning of e-government is misunderstood. It requires transformation of existing public procedures to more simplified forms but still maintains enough transparency for the public.

With the implementation of e-government, businesses between citizens and government services can be made available online every second. This enables government

agencies to align efforts to significantly improve service delivery and reduce operating costs. As pointed out by [20], an effectively deployed e-government initiatives make conducting business with government easier, on the other hand, privacy and security is maintained. It is important to note that e-governance is related to the utilization of e-government combined with processes for wider consultation within and between government, private sector and the public.

In conclusion, currently there is an increasing demand for rapid access to land related information as a strategic resource for development and business. The computerized multipurpose cadastre is one of the tools for the efficient handling of land, property related information beneficial to both government and private sectors, and land related information users across all sections of the community by adding value through the combination of data sets and making these widely accessible. In addition, [21] noted that e-government could be successful only if it is properly designed and accepted by citizens, companies and administrations.

7.2 INTERGOVERNMENTAL COORDINATION

In practice, many countries have a tradition of separate governmental institutions whereby the cadastre recording property boundaries and other information for taxation are separate legal registration systems under the control of federal ministry, and the local government being responsible for land and land use rights. Each ministry often makes its own rules, while co-operations between authorities depend more on personalities than on policies. This results in separate inquiries having to be made about rights of ownership and rights of use before any transfer can take place, leading to overlapping of efforts, inconsistencies and hence inaccuracies in the data with additional costs [21].

In conclusion, I strongly support the idea that one way to ensure closer cooperation between government bodies is to establish a higher level of land administration coordination board, such as the National Land Council or better known as *Majlis Tanah Negara* in Malaysia. This mechanism can help to coordinate the administration of land and the environment and can develop policies for handling land related data that are in line with the federal government and its local authorities. It can help to reduce overlapping powers between ministries, increase efficiency, and provide a forum in which improvements to land administration services can be discussed in the light of changing circumstances and any consequence needed to amend the law. It can also recommend policies for archiving data that may be needed in the long-term national interest and address personal privacy matters as well as the confidentiality of data in order to protect the interests of private citizens.

7.3 E-LAND (E-TANAH) MALAYSIA

To realize computerization of the overall management and administration of land in the country, the Ministry of Natural Resources and Environment (NRE) planned to create an integrated computerized system, known as the *Sistem Permodenan Pejabat Tanah* (SPPT) project or Electronic Land Administration System (e-Land). E-Land is designed to improve the delivery of land administration and management services in Peninsular Malaysia using an integrated ICT infrastructure. Currently, the Ministry of National Resources and Environment has implemented two (2) systems for the administration of land information, namely *Sistem Pungutan Hasil Tanah* (SPHT) and *Sistem Pendaftaran Tanah Berkomputer* (SPTB). Both systems are already being used in all State Lands and Mines Offices and District Land offices in Peninsular Malaysia.

E-Land is an integrated and a fully computerized system to handle the management and administration of Land Offices in order to improve the speed and quality of service delivery to the public for all land related transactions. E-Land enables the public to make payments online and print the payment receipts, checking details on their own land and so on.

E-Land consists of nine main modules with 85 major business processes in accordance to the existing National Land Code 1965 (Act 56). The business processes is supported by e-Land will maximize the utilization of the existing ICT infrastructure, taking into account the existing processes and procedures, and will be integrated with the existing systems accordingly.

The objective of e-Land is to develop a comprehensive system in land offices in order to modernize all activities that are related to land and to realize the implementation of electronic government in the public sector. Meanwhile e-Land's vision is towards the achievement of an updated, effective, and accurate National Land Administration System via ICT. In addition, the mission of e-Land is to develop and implement a National Land Administration System via ICT towards enhancing the growth of national development.

The focus of the project will be on major processes that can be implemented without any changes on the existing laws. One important aspect of the project is that the e-Land project does require any amendment to existing laws. Any required changes to the existing laws will be done later under different exercises. Nevertheless, the modules and e-Land will be designed to be flexible to address possible changes to the system because of the changes in the existing laws.

In general, the design of the module adheres to the best practices in application development. Emphasizes are given to aspects such as ease of use, security, flexibility, traceability and expandability. These fundamental design aspects of the module and e-Land in general will ensure that the system will be able to handle the existing and future requirements on the system.

7.4 E-CADASTRE (E-KADASTER) MALAYSIA

The vision of the Malaysian government is to become a developed country by year 2020 encompasses the realization of an efficient public delivery system at various levels. Among the national emphasis are land related matters, which include cadastral survey. The government has approved an e-Cadastre project under the 9th Malaysian Development Plan

(2006-2010) to be implemented by the Department of Survey and Mapping Malaysia (DSMM) that is aimed towards a fully digital Malaysia by 2015.

Since 1995, DSMM has embarked on a modernization program that saw the dramatic computerization of both its office and field processes of its cadastral survey division. The Digital Cadastral Database was created by capturing the surveyed accurate information of all land parcels. Under the e-Cadastre project, a comprehensive nationwide readjustment of the meshwork of parcels would be carried out based on a new geocentric datum. A dense network model known as the Coordinated Cadastral Systems of Real Time Kinematic Global Positioning System (RTKGPS) permanent stations has been established to provide precise geocentric positioning and is to be implemented through the e-Cadastre project.

The current system of cadastral survey is unable to capitalize on the advent of satellite based technologies. A complete revamp of the system is required before any improvement to the delivery system could be achieved. The new environment will allow various cadastral survey processes such as planning, layout design submission, field data capture, completed job submission, quality control, and approval to be carried out remotely via the mobile telecommunication network. Global Positioning System (GPS) will provide real time positioning at centimeter resolution homogenously to the entire country and coordinates will replace relative measurements as the ultimate proof of boundary mark position. Additional features such as building footprint and space images will be incorporated into the new database in a move towards a multipurpose cadastral.

To sum up, the primary objective of e-Cadastre is to expedite the delivery system for land title survey. This would entail the creation of a survey accurate database at the national level suitable for Geographical Information Systems (GIS) users. Various issues related to the generation of a survey accurate database need to be addressed. There are three main components in e-Cadastre, namely Coordinated Cadastral System, Virtual Survey System and Cadastral Data Integrity System. The implementation of Coordinated Cadastral System is a major part of the e-Cadastre project that includes field and office reengineering to reduce processes and increase the use of digital technology.

7.4.1 Coordinated Cadastral System

In a move to address problems regarding to the issue of the cadastral system's incompatibility with current technologies, DSMM had then decided to look into the feasibility of implementing Coordinated Cadastral System (CCS) in Peninsular Malaysia.

The main objective of CCS is to develop a homogeneous cadastral database based on the geocentric datum with a spatial accuracy of better than five centimeters in urban areas and better than 10 centimeters in semi urban and rural areas. The present accuracy of the Digital Cadastral Database is a few meters level and is not homogeneous. This is partly due to the inherent inaccuracy found in the underlying datum and unconstrained propagation of error within the network. Subsequently, in 2003, DSMM decided to adopt the Geocentric Datum of Malaysia 2000 (GDM2000) which is supported by permanent GPS tracking stations and real time kinematics stations. However, the Cassini projection is maintained but is now based on the new GDM2000 parameters. At the national level, the process requires the readjustment of the cadastral network based on coordinates obtained from GPS observation [22].

In order to achieve the above objective there is a need to establish a dense Cadastral Control Infrastructure grid of 0.5 kilometers spacing in urban area and 2.5 kilometers spacing in semi urban and rural areas. The underlying technologies needed for the establishment of Cadastral Control Infrastructure includes GPS positioning based on GDM2000 geodetic datum and least squares adjustment. Once the dense Cadastral Control Infrastructure has been established, the readjustment of the cadastral network will be carried out and this adjusted National Digital Cadastral Database (NDCDB) will then form the base layer for all future title surveys. The readjustment uses least square methodology and will distribute the residues homogeneously in the large cadastral network. Consequently, cadastral survey practices will be revamped to accommodate the use of least square adjustment. Validation of work under Coordinated Cadastral System environment will be much faster and simpler. The control infrastructure is currently supported by an advance RTKGPS network that can provide real time correction to field observations.

7.4.2 Virtual Survey System

Virtual Survey System will equip the field surveyor with ICT, total station, GIS and GPS. The surveyor will be able to interact with the system to extract information that is essential in field operation and most of the work will be automated to reduce tedious computation. The Virtual Survey System will reengineer the field processes and permit real time digital submission of completed surveys to servers located at the state DSMM for verification. The most obvious change will be to replace the current field survey system with the use of coordinates based system such as GIS and GPS.

All requests for title survey either from the land office or the private licensed land surveyors will be lodged with DSMM prior to field survey. The spatial location of the land parcels will be verified against the NDCDB to ensure that there is no encroachment. Initially the Department's Cadastral Control Mark group will facilitate the field survey teams by establishing GPS control marks surrounding the perimeter at any new request for survey. All information related to the GPS control can be accessed by the Cadastral Control Mark group, DSMM field officers and private field surveyors via mobile internet.

The field surveyor may start the survey based on controls obtained from existing marks stored in NDCDB, Cadastral Control Mark layer or through RTKGPS Network services provided by DSMM. Once the survey is completed, it would be submitted to the Virtual Survey System servers located at

the state DSMM for quality verification. The surveyor may choose to work in the real time environment or online through the website depending on the communication bandwidth available. Rules will be coded to control workflow and decision-making and subsequently minimize human intervention. The field surveyor will be informed on the acceptability of the job in near real time. This will allow the surveyor in the field to rectify the survey if required. The most significant change will be to allow surveyors the flexibility to use best practices in a digital environment. The final adjusted coordinates will then be posted into the NDCDB. Finally, a digital copy of the title plans will be generated based on the coordinates stored within the NDCDB and be kept in a separate database for security purposes.

7.4.3 CADASTRAL DATA INTEGRITY SYSTEM

Cadastral Data Integrity System comprises of all the office applications, which include pre-survey verification, field survey data computation and verification, digital title plans generation and approval. This system will be developed to ensure high integrity of the data and ready in GIS application. Various checks will be put into place to assist users when making decision on the validity of data before posting it to the database. The raster title plans, which are generated based on NDCDB will be delivered online to the Land Office.

New requirements would be needed to capture three-dimensional data to cater for strata, stratum and the marine environment. This process would be performed in the Electronic Strata Module that consists of Strata Lodgement Module, Electronic Strata Survey Module and Strata Verification Module. These databases will be coordinates based which are tied to GDM2000 to serve all future cadastral surveys better. The system will be integrated with other land related systems such as the Land Office and the Licensed Land Surveyors Board through handshaking process. Ultimately, the various databases will support the implementation of utility mapping.

7.5 ELECTRONIC STRATA MODULE

Electronic Strata Module consists of three module, they are Strata Lodgement Module, Electronic Strata Survey Module and Strata Verification Module.

7.5.1 STRATA LODGEMENT MODULE

Strata Lodgement Module is developed especially to fulfill the requirement of spatial database for strata. This [23] consists of four main functions as below:

a) Data Entry.
b) 3D Graphic Display.
c) Electronic Strata Survey Module (eSSM) Data Preparation.
d) Pangkalan Data Ukur Strata Stratum Marine (PDUSSM) Data Update.

The important of Strata Lodgement Module are:

a) To capture hardcopy strata data into digital format.
b) To check digital strata data received from Licensed Land Surveyor (LS) and Land Office (PTD/PTG)).
c) To prepare strata data for checking purpose at field.

7.5.2 ELECTRONIC STRATA SURVEY MODULE

Electronic Strata Survey Module (eSSM) is developed to perform strata job verification on ground and at the same time perform data collection by using the distometer available with the field officer [24].

Strata Job is divided into two phases, namely Phase 1 (*Peringkat I*) and Phase 2 (*Peringkat II*). Phase I describes how DSMM will react to the requisition for comment of a particular strata job while Phase II illustrates process taken by DSMM to prepare the Strata Title Plan before sending it back to Land Office. In the first phase, DSMM will receive the strata data from both Licensed Land Surveyor and Land Office. As a result, DSMM needs to review and examine it manually before sending their officers for field inspection.

While working in the field, the field officers will first retrieve the strata job to perform checking. Job checking can be divided into two sections, firstly direct observation and secondly observation by using data capturing tool, known as the distometer. Data captured will be stored through the Electronic Strata Survey Module application before sending it to the output file back to PDUSSM database. Once the output file produced by Electronic Strata Survey Module has been sent to the PDUSSM database, DSMM needs to prepare the comment towards the specific strata job before sending it to the Land Office.

With the implementation of e-Cadastre, users can now make use of the new strata application to carry out the verification process for both field work and office task while strata related PDUSSM database will be created for the purpose of reposting the digital strata data submitted by both the Licensed Land Surveyor and the Land Office. With this new approach, DSMM is able to create the digital strata plan and digital strata title plan. Therefore, the time taken to complete the Phase I and Phase II would be reduced.

7.5.3 STRATA VERIFICATION MODULE

Strata Verification Module is developed mainly to fulfill the needs of spatial usage for data checking from field check. This [25] consists of a few functions as below:

a) Display Strata Data
b) Display 3D Graphic
c) Display Strata Data Checking

After all the data have been checked, officers from DSMM can deliver the verified data after making remarks or comments on the Strata File to Land Office.

8 SUMMARY

In summary, once e-Cadastre is implemented, the time required for cadastral survey will be significantly shortened, thus allowing qualified titles, which are issued in advance of survey to cope with the fast-paced development in the country, to be phased out. The current National Land Code 1965 (Act 56) already permits the issuance of the final title without having to first issue qualified title. The image of the Department of Survey and Mapping Malaysia will be greatly enhanced with the expedient issuance of titles and for being the sole custodian of the complete cadastral database of the country, which is much sought after by many government departments and agencies.

It is envisaged that e-Cadastre will be fully integrated with e-Land to form a complete Land Information System for Malaysia capable of completing all surveys and title delivery within a week. The Malaysian Land Information System will fully serve as a digital system that will help thrust Malaysia into the digital era. This system will greatly benefit citizens who will receive their final land title within a short period and generate greater confidence in the land market.

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