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Smart Land Record Application Using Web GIS and GPS

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Abstract: Land plays an important role in the different administrative domain of a country like residential systems, environmental advancement, agricultural benefits, wealth generation and natural recourses as country population is increasing, needs of a proper record management is mandatory. Increase rate of industrial areas, cultivation and mortgage ability demands a systematic way to handle the land record. In this system we will use GPS and GIS technologies to full fill this need. This technology will help in preserving land records with maximum accuracy, portability and accessibility. This system will also provide resolution of a boundary disputes without effecting the physical location of land. Disputes regarding illegal land grabbing, taxation and owner ship can also resolve easily using this system. It might be realized that there are some troubles facing the decision makers regarding utilizing & managing the available data in some of the public sectors organizations in the Pakistan, in addition to what the local residents in the Pakistan are facing in identifying their land properties' borders, land owner ship and taxation history.

Keywords: GIS; GPS Technology; Land Record Technology;

I. INTRODUCTION

Land is gift from Allah; it remains for all nature, living and unaware. It includes all-natural resources that human being gets free from air, water and arrive. The terms land includes all that nature has made on the earth, over the earth and underneath the Earth's. Land plays an important role in residential and agricultural of the country. Due to quick growth rate in population, cultivation, mortgage ability& industrial areas enhanced the importance of land record management.

A. Statement of the problem

Existing land record management is a manual process running under supervision of Board of Revenue. The currently used system for land record in the Pakistan is extremely traditional. They face duplication land owner ship etc. Conflicts between data on maps and on ground are frequently faced and decisions relating to these problems cannot easily be made.

High level administrators & decision makers, who are not technically professional in the field of land record, are facing troubles in managing land owner ship and taxation history, because it is not easy for them to deal with the available software and its tools during utilizing the applications of this software as: ARC Map, ARC View etc.

B. Definition of the terms

GPS: The GPS (Global Positioning System) is set of 24 satellites positioned in space by U.S Branch of Defines. It is a satellite-based route framework was initially invented for military purpose design in 1980. This late proved beneficial for non- military personal as well.

GIS: A GIS (Geographical Information System) is a system designed to store, capture, analyze, manipulate, manage and present all types of geo-graphical or spatial data.

Spatial Database: A spatial database is also known as geo-database allows storing or querying an object that represents geometric space. This geometric database may consist on simple geometric objects like points, lines and polygons.
Background of the research
Existing land record management is a manual process running under supervision of Board of Revenue. Data in the system has two parts

C. Research objective

The objectives & significance of this research project are to prevent duplication land owner ship, identify unauthorized land, provide complete taxation history, assessment of resource allocation with accurate, portable and centralize database structure. This application is unique within it offering graphical and statistical knowledge about the land and can be utilize by the government to do proper management of use less area of country.

D. Challenges

Smart land app for mobile system is design with common and understandable features for a user. Rising

interest of a common man in mobile and internet allow them to access information at door step.
Application first converts land data into digital form so it can be store in database and available for indexing on it for GPS and GIS. This data is capture by virtue of GPS device which automatically generates the GPS coordinates for any shape and boundary while device is moving across the total land area. Patch information is retrieved on the basis of a physical location of owner with access rights.
Smart land app will resolve disputes regarding illegal land grabbing, taxation and owner ship mostly reported in rural areas.

E. Contributions

Contributes of this paper is the revaluation of the concept of IT&T (Information technology and telecommunication). Especially in a modern android application programming and computer networks. This paper will explore modern techniques and will help to change the thinking of a conman Pakistani.
It is quite difficult to formally prove the correctness or efficiency of this Smart land system initially but as this system will be implemented on ground, hopefully strong evidence will be analysis in for or against its validity.
Smart land app is designed specifically to maintain and established correct ownership for any pieces of land exist in the targeted area. This application will be implemented at the root level to avoid inappropriate concessions to or influences from traditional manual-oriented systems.
This newly proposed application is based on modern infrastructure that can cope well with the diversity of land information; this app provides a base for novel solutions in future.

II. LITERATURE REVIEW

LUPGS methods are combined with Arc GIS platform, .Net and Oracle database to produce effective land management and automation system with maps, reports and other concern document. This system provides efficiency and flexibility in new situations without duplication [1]

Used XML with Goggle API's to draw a patch on the basis of latitude and longitude. Data is stored in the form of points, lines and shapes. Local addressing technique was adopted to provide searching facility for any query. One big problem in this land information system was the usage of XML which causing data overloading and slow performance [2].

Threshold technique was used to compare the old image with new image taken by remote sensing and detected the change in land area [3]. Remote sensing patch and vector polygon combine to automat land use analysis. The problem in this system is that the small partial change can interrupt the detection which is untraceable some time. Internal tempering or editing in pixel or image cannot be detected so this system is not reliable [3].

In this system image processing was applied on the images to convert the image in scalable vector graphic. This data is then converted into XML form and store in geospatial database where it combines with other data and generates patch numbers for searching purpose. The main drawback is the time consumption because lot of time required scanning the images physically [4].

Similarly, a predictive analysis about land variation accepted in near future is discussed in [5]. For example, decreasing trend can indicated toward upcoming food crises. Water body, agricultural and residential trend can also be predicted using ground survey this system [5].

Another system is a combination of hand handled device with PDUK database. This database provides information such as boundary mark, area and distance coordinate. This device is compatible with web routes and tracks and shows the map on device during survey. Surveyor can create, define and subdivide the land to solve any dispute. All the near coordinates are available for lot parcels. No Doubt this is a slow process and they also need land owner to confirm that parcel [6].

A user friendly system is designed in such a way that it can facilitate user for any enquiry. Graphical and attribute data are stored separately into Geo spatial database. Ajax queries are used for data processing and searching. Web GIS allow user to access information anywhere. Different rights were available in this system for different administrative matters [7].

Data gathered from physical survey and relative information can be downloaded from GPS device to database directly. Images are taken from satellite and later it combines with land record and build geodetic survey network. This system has supported in taxation, infrastructure development and forecasting. This system also provides analytical detail based on the past data. The big lacking in this system is the lack of control and human resource training [8].

Whereas, a technique proposed by Zhang. Et al. produces some useful suggestions after analyzing the land data. These suggestions help to organize economy and develop new urban areas Construction of land can be done according to the plan provided by Zhang. Land acquirement can be stricter and provide more security to farmers and increase their living standards [9].

In [10] the author focuses on indexing. This system is more graphical and statistical as compare to other systems with graphical outputs addressing information queries. GIS

technology is integrated in the system which enables data acquisition and visual expression. Spatial data is efficiently managed using GIS. This system is complex because it deals graphical data, attribute data and multimedia data.

A. Existing Land Record Management Systems

Existing land record management is a manual process running under supervision of Board of Revenue. Data in the system has two parts:

B. Geographic Data (Maps)

In manual system Geographical data are the handmade maps which are drawn on the basis of land parcels with "quantifiable measurements". Some maps are small which are designed at settlement time and reflecting single units. New version of this map will design at the time of second settlement till then these small maps remains unchangeable. Large maps are the combination of several small maps reflecting big village or big area [11].

C. Attribute / Alphanumeric Data (Registers)

The support data for land is attribute data it consists of Inspection register, daily diary, field book, mutation register and owner record register. Inspection register contains crop inspection report. Daily diary is consisting on the daily report having daily proceeding are kept for example transfer, mutation and other parallel activities. Field book are basically small map define in alphanumeric way. Mutation register updated at the time of mutation of land. Owner record register describe information about land owner [12].

D. Conventional Land Record System Weakness

Manual land management system has lots of flaws and weakness. One of the main weaknesses is a security. Because land data is a sensitive data and it can be leaked or copied for misused due to lack of security mechanism [13]. Records keeping in conventional file system are done in registers which is now considered old fashion technique. Searching and updating data in registers is time consuming. Fraud can easily be executed in file system and records can easily be change by any unauthorized person which can become quite problematic for owners.

Some people do not follow proper registration method and bypass the operating procedures define for owner ship of land. They launch fraud by paying amount to accountant or on their personal relations. Accountant can have misused or temper land information because he is the only person who know all the procedures and land parcelling.

Current land management system of Pakistan is outdated and full of error. Lack of technology awareness has made the system corrupt. No modernize equipment or technology is involved in land management which is causing so many disputes and confusion [15].

Because land is a valuable property to any one so disputes and argues for the land may remain at any cost [16].

Some of the short comes in existing land management systems are described below.

1. Manual system encourages people to encounter the fraud and corruption in the records. This act can become a problematic in the end like fake ownership and fake deed can occur.
2. Dispute regarding an owner ships are increasing day by day. Approximately 80% of the cases in court are about the dispute of land.
3. Because survey of the land is done manually so there is every chance of error in calculating the land area and determine the boundary.
4. After a manual survey drawing of the map is also done by hand which can cause mistake to happen. There is also a possibility of error or fraud in hand drawn map.
5. Manual land management process can become a time-consuming process.
6. Interruption of middle man can cause so many problems in proper land management record keeping.
7. Illegal connection and political influence can make this system inaccurate.

E. Traditional Source of Land Data:

In Past Land data can be collected from different sources, however, in modern days this information is generated through GIS and GPS technology as shown in Figure 1.

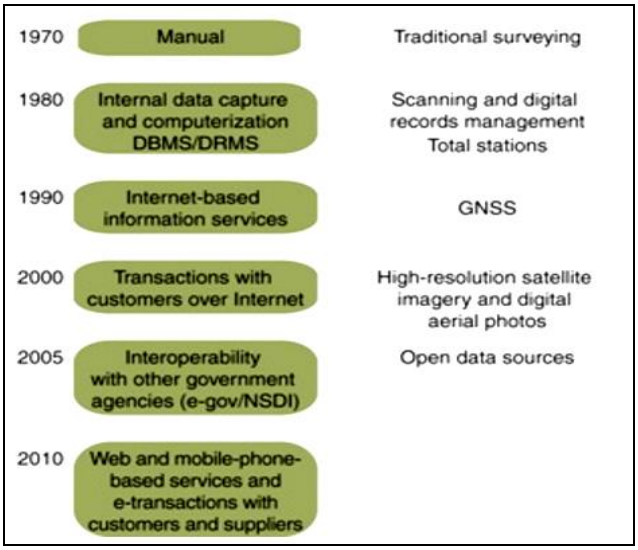

Figure 1: Traditional source of land (Source: [17])

III. METHODOLOGY

Our proposed system is basically a 3-layer architecture which is shown in Figure 2.

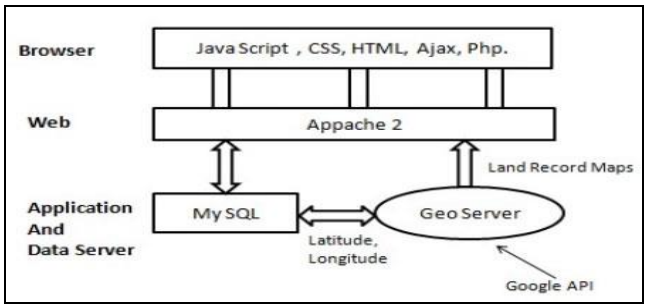

Figure 2: Architecture of proposed System

Currently working land management system managing the records on papers. Government is following very old registers method to keep the records. Searching of any record in current system is quite difficult and time consuming. The big disadvantage of currently implemented land management system is slow, venerable and messy. There is a need of atomize and computerized land management system which can overcome these issues.

Digitization of current can be done in two parts. In first part data is inserted in database. In second part, map need to be digitized. Map present in current systems are handmade and they can be digitized by using Google API's and GIS techniques which is the most significant and important step. Patch boundaries are measure by the latitude and longitude collected during physical survey. Centric of each patch is also calculated and saved into Geo spatial database along with the coordinates.

A. *Identifying Patch*

In order to get accurate patch, surveyor is asked to move along with the physical boundary of the area holding GPS device in hands. GPS device store each coordinate in sequence and later store this data in spatial database (See below Figure 3 - A, B, C). If any sort of overlap occurs during survey GPS device generates a warning to surveyor indicating the boundary overlap with neighbor patch. This checking is the responsibility of polygon problem method. Centroid and coordinates are saved into spatial database for each patch and boundaries are drawn.

Figure 3: Patch Boundary (Source: [18])

a) Moving along the land boundary to store coordinates while holding a GPS device.

b Complete patch boundary map is store with balloon representing Centroid point.

c) Marker on each patch shows the Owner name.

B. *Database Glance*

Figure 3 represent the database view with patch and owner Id's. Table.1 Geographic data and Attribute (Centroid) data are managed collectively in the database

Table 1: Geographical Data and Centroid Data

Patch ID	Owner ID	Kehwat No	Kahasra No	Land Type	Index Centroid-Latitude	Index Centroid-Longitude	Date
1	5	8	53	Commercial	31.53492	74.64263	12/11/2012
2	7	6	3	House	28.56322	74.38721	16/11/2012
3	25	12	39	House	30.1355	67.1355	16/11/2012
4	15	70	93	Commercial	30.1684	67.5644	16/11/2012
5	23	33	14	House	30.1454	67.0016	16/11/2012
6	28	72	87	Plot	30.1543	67.1579	17/11/2012
7	6	60	79	House	28.426	66.4666	17/11/2012
8	2	21	75	Commercial	28.1346	66.1234	17/11/2012
9	1	70	55	Commercial	28.03464	66.9664	17/11/2012

10	47	80	91	House	28.4677	66.1354	17/11/2012
11	41	28	27	House	28.6987	66.2354	17/11/2012
12	24	50	81	House	29.7943	66.0133	20/11/2012
13	12	13	49	Commercial	29.4113	66.0016	20/11/2012
14	46	79	26	House	29.7895	66.9564	20/11/2012
15	4	75	24	Plot	29.1676	66.1799	20/11/2012
16	10	35	90	House	30.4979	67.1646	20/11/2012
17	9	96	18	Commercial	30.14566	67.8765	20/11/2012
18	13	32	51	House	30.7955	67.9964	20/11/2012
19	16	89	21	Plot	28.5698	66.1647	20/11/2012
20	14	26	99	House	28.4793	66.9646	20/11/2012
21	57	95	58	Commercial	28.7313	66.3916	25/11/2012
22	27	55	100	House	29.7911	74.4676	25/11/2012
23	22	91	61	Plot	30.14663	74..4631	25/11/2012
24	49	27	101	House	30.9313	67.13466	25/11/2012
25	60	81	65	House	30.28624	67.3144	25/11/2012
26	58	49	88	Plot	30.9733	67.1676	25/11/2012
27	59	26	85	Plot	30.4963	74.1647	28/11/2012
28	55	82	45	Commercial	28.43133	66.16476	28/11/2012
29	48	39	72	House	30.6316	74.1343	28/11/2012
30	37	93	60	Plot	30.61134	66.1644	28/11/2012
31	26	14	21	Commercial	35.3346	67.4364	28/11/2012
32	52	87	70	House	35.6769	78.1343	28/11/2012
33	40	52	53	Plot	35.2313	78.14313	28/11/2012
34	53	24	110	Commercial	35.4113	78.5213	30/11/2012
35	30	90	16	Plot	35.0134	78.1313	30/11/2012
36	50	18	102	House	35.1346	78.00231	30/11/2012
37	11	51	117	House	35.1646	78.6546	30/11/2012
38	17	21	46	House	34.4767	77.0131	2/12/2012
39	19	99	94	House	34.1136	77.6476	2/12/2012
40	20	58	103	Plot	34.1346	77.36464	2/12/2012
41	18	31	35	House	34.79636	77.6466	2/12/2012
42	21	100	96	Plot	34.14646	77.13136	2/12/2012
43	29	61	32	Plot	34.4463	77.8313	2/12/2012
44	31	15	89	House	34.01313	77.00313	2/12/2012
45	33	101	26	Commercial	31.23546	74.9536	2/12/2012
46	32	65	95	Plot	31.1363	74.1313	5/12/2012
47	56	88	6	Commercial	31.0363	74.23554	5/12/2012
48	54	85	5	House	31.4933	74.1546	5/12/2012
49	38	45	111	Plot	31.7966	74.0215	8/12/2012
50	36	87	128	Plot	31.13646	74.68747	8/12/2012
51	43	42	122	Commercial	31.01361	74.9663	8/12/2012
52	35	115	53	House	31.9746	74.0215	8/12/2012
53	45	110	121	House	31.7953	78.3434	8/12/2012
54	8	16	5	Plot	31.9796	78.65321	8/12/2012
55	44	102	116	House	32.6463	77.36446	8/12/2012
56	3	117	42	Plot	32.4676	77.13463	15/12/2012
57	51	46	115	Commercial	32.9461	77.034163	15/12/2012
58	42	94	120	House	32.001313	77.6464	15/12/2012
59	34	103	114	House	32.1364	77.03646	15/12/2012
60	39	53	63	House	32.64633	77.933	15/12/2012

C. Searching Approach

In new computerize system searching is carried out on Centroid indexing for each polygon. To search any particular patch, we manually provide the value or select the desired patch. Application will send the coordinates value to system which consider the spatial database and finds the nearest or accurate value of a Centroid according to the incoming values. Algorithm finds out respective polygon and start plotting it to generate map along with the owner details. The indexing on Centroid will optimize the searching of any patch in database.

Our proposed system as shown in Figure 4, will search fast because we will apply indexing on Centroid. Instead of searching coordinates directly in the database we use searching of Centroid and then compare the coordinates.

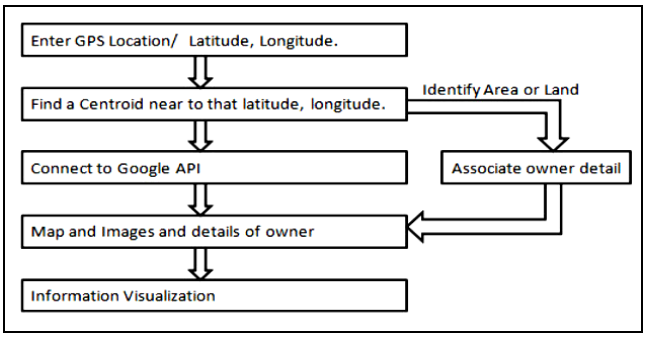

Figure 4: Centroid based indexing fast searching procedure

D. Supportive data management:

Land management is a huge task and it possesses so many relative information that need to be store in database as well. This information must be treated as supportive information and have different attributes like:

(a) Value

Value describes the worth of the land. It is necessary to store the value of the land at the time of survey which is an estimated value of that area of land. This information can be available from property tax bills or other documents or it can be taken from third party survey.

(b) Ownership

Owner is the person who owns that land. This supportive information includes the name of that piece of land and amount of right that man have on that land. Deed and mortgage document can describe the information of the real owner of that land.

(c) Land Use and Zoning

Any limitation either legal or logical on the land is needs to be store in database for future concern. Such limitation can usually have implemented by government.

(d) Address

Location of the site is identified by its address. This address includes zip or street code and other information. Structure of the building, entrance (single or multi) and size need to be store in database as supportive data.

(e) Legal Descriptions

Most of the lands that have a legal issue, may be about its owner ship or size. Proper legal dispute information needs to be store for future framework.

IV. RESULTS

A. Challenges for Smart Land System:

Defeat the manual system and established a digital, computerize and advance land management system is not an easy task. There are always some predefined and sticky issues present. These issues can prove a big challenge in the system development and need to be address carefully.

Some general rules for land record management are as under:

- Try to reduce involvement of multiple agencies if not, try to build coordination among them with some formal agreement or memorandum.
- Offer different land administration program to change business cases or to sustain them.
- Use same administration for urban and rural areas regardless of the institution. Though there may be some variation exist in development control standards.
- Resolution of dispute should be standardized in which court is a last resort.
- Minimized the low barriers of entries in land administration.
- There must be specific plan for poor and outdated data improvement. Budget should be allocated from outgoing maintenance.
- Land professionals like surveyors and lawyers should be the part of the system to tackle any pragmatic changes.
- Land administration should monitor under political influence to manage sufficient time horizon and to deal with other problems.
- Disputed land matter should be tackle politically.
- Heavily budgeted project may require huge investment in term of hardware and software

B. Benefits of Smart Land Record System

There are numerous benefits to smart land record system and those have been illustrated in Figure 5.

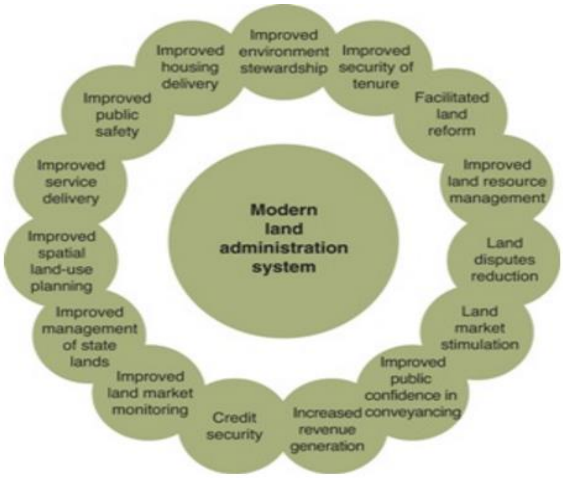

Figure 5: Benefit of Smart Land Record System (source: "Systemhttp://agrocorpglobal.com/key-benefits-asociated-with-digitisation-of-land-records")

V. CONCLUSIONS AND FUTURE RESEARCH

We get the evidence that by using GPS and GIS technologies we can build the more accurate, fast and robust land record management system. Latitude and longitude points are using to located and identified any land patch. Use of index on Centroid will made our system very fast. Fraud and tempering can be detected by comparing physical and official data. Our system can be useful for government to estimate and analysis agriculture or land taxes, tempering of record, fraud detection and transfer of ownership will come on the finger tips. Record, fraud detection and transfer of ownership will come on the finger tips.

In future GPS and GIS technology can be used by the government for different smart solutions to provide strong grip on the following administrative units.

- Toll collection
- Improved services like fire, safety or any emergency.
- Real time Parking allocation in public places
- Vehicle tracking GPS+GIS
- Identifying "at risk" populations (high risk health groups)
- Estimated rainfall across the country like shown in Figure 6.

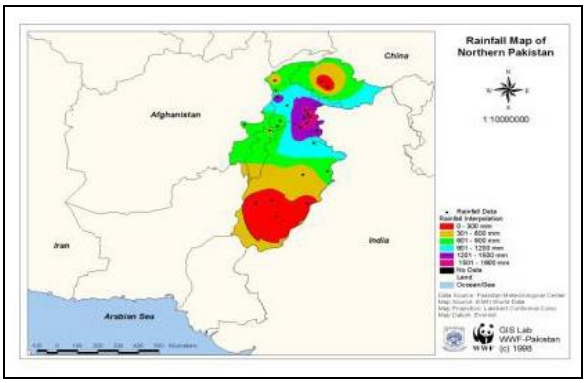

Figure 6: Estimated Rainfall Map of Northern Areas of Pakistan (Source: http://www.maplandia.com/pakistan/rain/)

- Identification of different diseases and its prevention as dengue map shown in Figure 7.
- Can deploy other smart solutions.

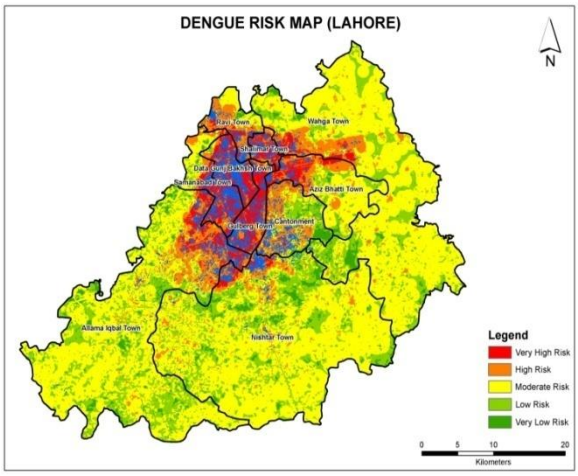

Figure 7: Dengue Risk Map of Lahore (Source:www.researchgate.net/publication/_Geo-)

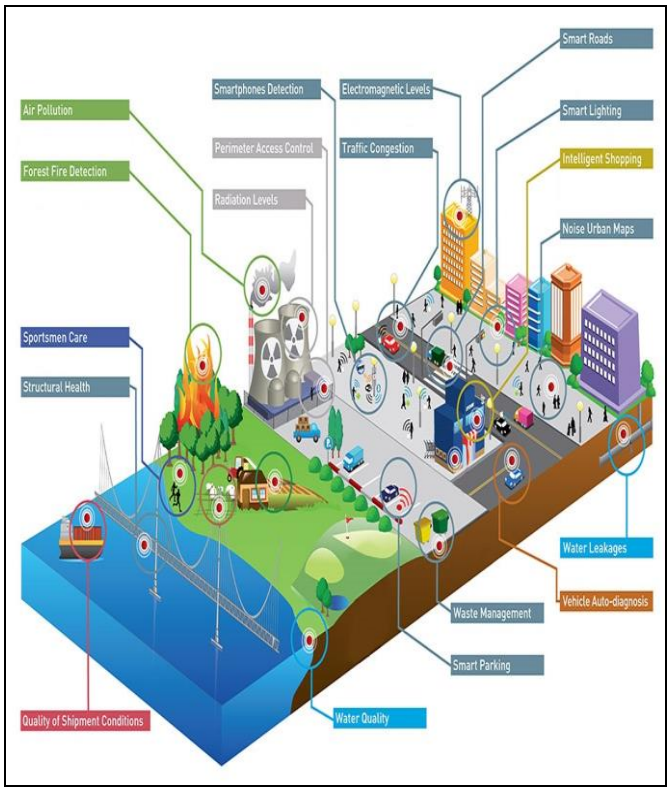

Figure 8: Various Smart solutions at different locations (Source: Nahrin, K., Shafiq-Ur Rehman, M." (LIS) 2, December 2009)

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