City Automation Using RS/GIS and App Development

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ABSTRACT

The objective of the article is to present a model and practical theory about city automation system. It is assumed as a controlled environment using technology intervention to save the natural resources, air, water, land and people, creatures in air, water and land with maintaining the health and safety of people. Controlled environment using technology intervention is to save the environment, maintain peace, right to live with honor and equality, right to development, technical advancement, natural resource management, food management, water management, land management, health, transportation and education management etc. in a city. The model can be further implemented in a city.

Keywords: City automation; Big data; Geospatial; Green technology; Controlled environment; RS/GIS; Smart collect app; Big data

INTRODUCTION

This paper is focusing on the model or idea of a city automation system using RS/GIS technology and App development. Today it is the need of geospatial and temporal data collection, development of a big spatial data collection, Mobile App, its utilities and analysis for smooth functioning of a city.

The city automation [1] is not a big challenge in any country of the world. The automation system may help even in pandemic conditions in a city using the big digital data collection, storage, analysis of the data and support system. Such cities may also be called as "smart city". New York city, United States was declared as the smartest city of the world in 2017. After the launch of IBM Business Analytic solution Centre and thousands of App [2] with their proper utilization made the city smartest. San Francisco, United States is smartest due to its smart parking, vehicle sharing services and internet speed. London UK became smartest due to its Largest free WiFi Network [3], Smart City Research Centre, which studies initiatives to make the city smart, Smart tech communities and smart vehicle system. These cities also smart due to their urban planning, health facilities and their proper utilization, livable world, education, business [4] and ecosystem, green world, clean fuels etc. Renovation and retrofitting is also a basic component of a smart city.

Either the situation of natural disaster or pandemic spread around, both are a challenge. The mitigation, health facilities and proper management becomes the priority in such conditions. Taking the example of CORONA which became the global pandemic due to human transportation from one country to another for their business. Though World health Organization (WHO) has given the directions to control it but could not be controlled due to lack of preparedness and lack of health facilities for pandemic situation. For future we may have a proper vision to control such situation using RS/GIS technology and android apps development.

CITY AUTOMATION

Development and execution of a city management in a controlled environment is city automation. In this article an idea has been given for city automation system development. There are two approaches that can be followed by a city

• Top to Bottom approach,
• Bottom-up approach

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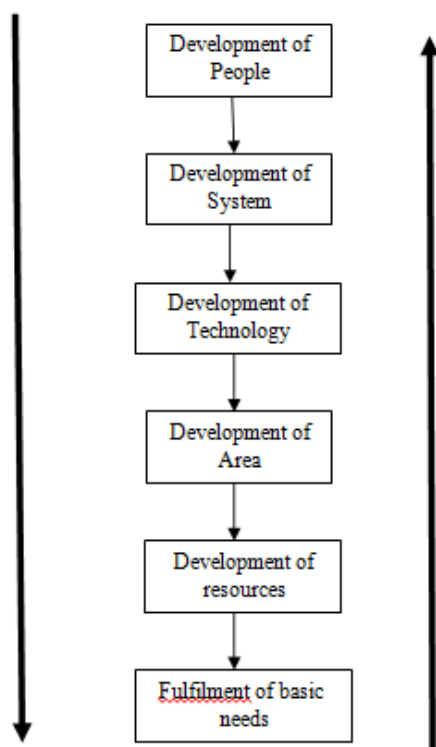
Figure 1: Top to bottom and bottom-up approach for smart city development

Development of people indicates the educational, economic, morals and technical growth of people. The development of system means that the things must run in systematic way. A well-defined and well planned system can be implemented for execution of any system. The intervention of technology can enhance the speed and efficiency of a work. So echo friendly technologies must be involved. That can make the system more sustainable and reliable. The sustainable environment can be developed using green technology of area development for energy, water, waste, education health, building, transportation and safety as shown in Table 2. Development of resources states the job, food, facility, income, energy, health etc. While fulfillment of basic needs indicates the basic human rights food, water, clothing, houses and clean air. The above factors are the growth indicator of a country. If the growth of a country maintains the environment also than the development becomes sustainable development. That causes enhancement of GDP in a country. Technology is to change with development. It must be eco-friendly always.

Table 1: Green Technology for education, health, people, waste, water energy, safety and transport

Education	Transportation Management
-Science, technology and moral value oriented education system	-Online traffic, fleet management and control
-Interactive learning and teaching	-Transport services for health, food, people, women, doctors and employees like OLA Cabs
-Global collaborative learning and teaching	
-Online digital content	- Smart vehicle with low power consumption
-Massive Open Online Course	Satellite fleet control system
-Global collaborative technology sharing	-Smart electrical and electronics vehicle
	-Common vehicle transports.

Health Care	Living Areas Development
Smart Apps for disease identification and analysis Online multispecialty Doctors	-Buildings
	-Markets
Remote health care Doctor cabs service	-Parks
	-Pedestrian path
Health Geographical Information System	-Smart roads
	-Amusements
Online Health record system using unique ID	-Solar vehicles and appliances

People and Resource Safety	Waste Management
-Satellite, CCTV monitoring and drone surveillance	-Waste automation system
	-Green waste to manure machines
-Artificial intelligence and Remote sensing technique can be used for safety automation.	-Green waste to paper machines
	-Electronic waste management
	- Hard waste management

Water Management	Energy
-New water conservation techniques	-Power requirement and generation management
-Underground and over roof water tanks	-Solar energy plants
-Water pressure control device on sources	-Distribution automation system on requirement basis
	-Renewable energy sources
-Water cleanliness	-Energy recycle, development and storage
-Proper water utilization system	techniques from mechanical to electrical

IMPORTANCE OF CITY AUTOMATION IN PANDEMIC SITUATION

To identify most susceptible areas and their causes, geographical and environmental conditions of vector born disease is the first step in pandemic situation. So the areas could isolate for better treatment and to avoid spreading the disease in other connected areas.

Here vectors are living organism that can transmit infectious pathogen among humans, or from animals to humans. Many of these vectors are bloodsucking insects, which ingest disease-producing microorganisms during a blood meal from an infected host (human or animal) and later transmit it into a new host, after the pathogen has replicated. Often, once a vector

becomes infectious, they are capable of transmitting the pathogen for the rest of their life during each subsequent bite/blood meal.

Since 2014, major outbreaks of dengue, malaria, chikungunya, yellow fever and Zika have afflicted populations, claimed lives, and overwhelmed health systems in many countries. Other diseases such as Chikungunya, leishmaniasis and lymphatic filariasis cause chronic suffering, life-long morbidity, disability and occasional stigmatisation. The novel corona virus (COVID 19) is recently introduced in September 2019 in China. That spread all over the world has became the global pandemic. Millions of death cases are occurring in the world due to this global pandemic as there is no vaccine discovered till now.

But rather than vaccine can we have another solutions to fight with such situations?, Is geospatial and remote sensing technology can help a bit or more to health sector? So the Idea came into existence that there may be multiple solutions to protect or fight against pandemic situation.

If we are well aware with our geographical locations and environmental conditions of more susceptible areas with their causes it would become easier to control the pandemic situation.

GIS based pre analysis of holistic reports of various hospitals of vector borne disease and to correlate them with geographical and environmental conditions using geospatial technology can support in better management during pandemic.

The Satellite Imagery will also be used to study the impact and change difference during pandemic situation and to identify the presence of elements in the atmosphere.

GIS based Apps can help to identify and record keeping and record tracking of an infectious person. It can also help to get alert if any infectious person is roaming around with another person. There are tremendous ways a GIS based app can help to the health sector in health automation.

Monitoring and control pandemic in hotspot areas can be done using remote sensing technology such as DRONE, AI Robots, various remote sensing and alarming devices.

In biological wars GIS -based models to predict spatial risk patterns have great potential for providing predictive capability for vector-borne diseases. A GIS spatial backbone can also be incorporated into a computer-based decision support system as a tool for analysis and presentation of relevant environmental, entomological, or epidemiological data. This type of system can revolutionize surveillance, risk assessment, and prevention strategies for vector-borne and diseases, manage and mitigate pesticide resistance, and

Permit focusing of resources and talents on prevention efforts in the areas at greatest risk.

Here are the steps for health automation in pandemic situation:

Step1: Holistic data collection from all government hospitals and major private hospitals.

Step2: GPS Location collection of hospitals

Step3: GIS development using very high resolution satellite image (CARTOSAT and LISS 4)

Step4: Satellite imagery comparative (LISS 3) study

Step 5: GIS Based Apps development

Step6: Monitoring using DRONE, AI Robots and Sensors using android apps

The increment of pandemic COVID 19 cases Geospatially in Uttarakhand, India within five month in the year 2021 is given below:

Figure2: COVID-19 cases in Uttarkhand as of 29.06.2021 (source: internet)

Table2

District	Total cases	Recoveries	Deaths	Active Cases
Total	3,39,933	3,24,766	7,095	8,072
Almora	12,019	11,189	140	690
Bageshwar	5,649	5,381	48	220
Chamoli	12,056	11,689	60	307
Champawat	7,480	7,178	53	249
Dehradun	1,11,223	1,06,410	3,491	1,322
Haridwar	51,080	48,606	972	1,502
Nainital	38,797	37,610	912	275
Pauri Garhwal	17,479	16,354	272	853
Pithoragarh	9,945	9,523	122	300
Rudraprayag	8,613	8,310	84	219
Tehri Garhwal	15,748	14,693	106	949
Udham Singh Nagar	37,535	35,960	761	814
Uttarkashi	12,309	11,863	74	372

In the given Figure2 the highest cases were on 07th May, 2021in Uttarakhand.

Table 2 statics shows the highest mortality ratewere in Haridwar due to COVID 19 positive cases while highest total cases were in Dehradun district of Uttarakhand. The cases were more in those districts that are near to the national and international airports, the population was large and their geographical location is near to the water, and the climate was supporting the spread of virus.

The presence of humidity in air such as in coastal areas like Keral, Maharashtra and Gujrat in India.
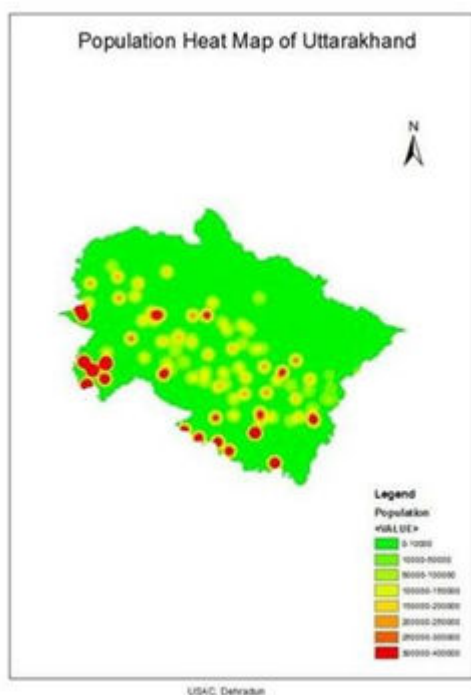

Figure3: Population heat map of Uttarakhand

Figure3 is showing the population density in various areas of Uttarakhand that may be a big factor in spreading of any disease. The RS/GIS based city automation system may play a great role in controlling of pandemic or any other disease. In normal health issues also RS/GIS based telemedicine [6] and health automation [7] is a powerful tool in inaccessible areas due to geographical conditions.

The RS/GIS technology intervention is powerful tool that is capable to execute the city automation system with more ease. It can help in all the fields of education, transportation management, health care, living areas development, people and resource safety, waste management, water management and energy sector etc using GIS software like ERDAS Imagine, ARCGIS, Q-GIS, GRASS GIS etc. and GIS based android Apps. Now there is a list of open source GIS software available.

RS/GIS BASED APP DEVELOPMENT

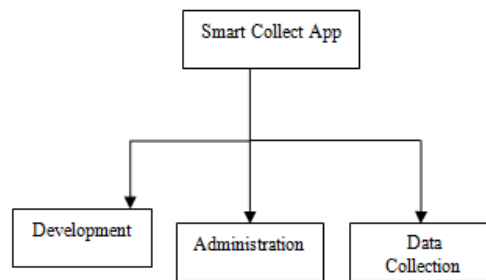The App is having three modules as shown under in figure4:

Figure4: Modules of smart collect android app

The App Development The development module is to design the forms, fields and enteritis type to collect the data form data collect module.

The designed form will be in .xml form type it will be downloaded in android phone to synchronize with data collect App module.

The data collect app is capable to collect the information in online and offline mode.

The collected information/data will be sent to receiver/administrator site. Here the collected data is present in a excel sheet form that can be analyzed, monitored, mapped and modified.

Open Data Kit (ODK) is free, open-source software through which The App can be customized according to your wish.

That allows data collection using Android mobile devices and data submission to an online server, even without an Internet connection or mobile carrier service at the time of data collection.

ODK Build is used to design a form to collect data.

- Go to ODK Build at
- Create a new account or log in with an existing account. Note that this account is different from your Google Account, and you can choose to use a different login and password. Your forms will be saved to this account for future reference.
- Add questions to your form by clicking on the type of question you'd like to add (eg. location, text, etc.) at the bottom of the page.
- Once you're satisfied with your form, save it to your ODK Build account. Go to File > Save Form As. Next time you log in to your account, you can select File > Open to open the form.
- To download the form to your computer, select File
- > Export as XML. You will see xml code. Click the "Download" button to save the file to your computer as an .xml file. The format that you will import onto your mobile device in the next step is shown in fig. 5.

Figure5: Format of form

Now set up your instance for ODK Aggregate to deploy and upload the form

ODK Aggregate, allowing you to host survey forms and responses on a your own cloud-based server.

- • Click "Form Management" tab at the top of the page.
- • Click "+Add New Form" button.
- • You will be able to select the form to upload from your computer. Choose the .xml form you wish to upload to your ODK Aggregate instance.
- • Click Upload (fig.6)

Figure6: Uploading Form

Install & Configure ODK Collect as shown in fig. 7

- Go to the Google Play Store and search for ODK Collect.
- Open the ODK Collect app.
- Click on the Menu (three dots in the upper right corner)
- Click on General Settings.
- Under Server Settings, click on Type so you can change the destination path for where your ODK Collect data will be sent.

Figure7: Smart Collect App

View you're Data

- In your ODK Aggregate instance, click on the Submissions tab and select the form "Sample" from the drop-down menu, or the name of the form whose

Submissions you wish to view as shown in fig.8. Click on the "View Submissions" button next to the "Sample" form.
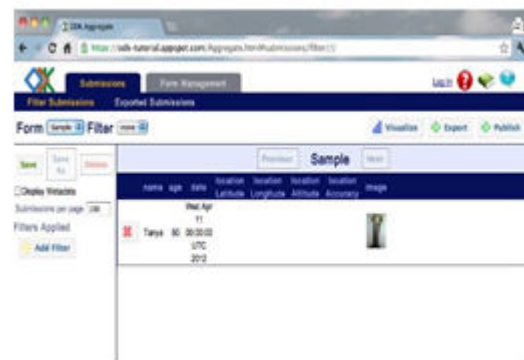

Figure8: Viewing the submitted data

- You'll see all submissions, created by yourself and others, who have sent completed submissions to your ODK Aggregate instance. Submissions with photos have a link on the far right of the row to view each individual photo submission.

You can also view your data in Google Earth.

~> On the "List of Forms" page of your ODK Aggregate instance, click "Create KML file."

~> Several options will appear. For "Field to Map," select the field which corresponds to your form's GPS location.

APPLICATION AND IMPORTANCE OF RS/GIS BASEDDATA COLLECTION AND CITY AUTOMATION

The data collection app is a useful tool in various domains of city automation system. There are seven major domains where the smart data collection and automation techniques are applicable as described in fig.9.

Global Network Connectivity (International Airports, Internet, Communication System): It is the global interconnectivity of smart cities in terms of path, digital data and communication technologies. An automated/smart city must have an international smart city airport that will help in transportation from one smartest city to another smartest city. For technology and skill sharing. This will further help in global development and ecosystem protection. The fast internet connections and devices are the backbone of any smart city [5].All artificial intelligence, apps, digital data creation/collection, and sharing work with support of internet connectivity. A strong communication system that include audio, video and text and other multimedia elements such as hologram through the communication network and satellite are the part of a smart communication system. The communication system will keep

Figure9: Domains of city automation system

People connected all the time, It will play an important role in modern education system, crime reduction, human values, protection, publicity, disaster management etc. The communication model must be event based on cloud network and ground network.

Corporate and Government System(National and State Infrastructure of protocols for System Execution, Deliverables) : This is the infrastructure of administration

/constitutional boundaries geospatial map of Dehradun smart city area in Uttarakhand (Fig 10) on which the set of rules applicable to the corporate, government and all responsible

business and production units regarding to information technology and secure information sharing. Other law can be implemented for the benefit of nature and human values and development.

Figure10: Geospatial Map generation for planning (Dehradun Smart City Area in Uttarakhand)

Administration and public dealing: Administration and public dealing is the implementation of government policy and to maintain discipline in the field of academic disciplines that studies this implementation and prepares civil servants for working in the public service. Public administrators are public servants working in public departments and agencies, at all levels of government for betterment (fig. 11). They play important role in decision making, execution, public dealing, finding a better solution of a problem, man-made and natural resource management. They are very much helpful to develop a controlled environment of a public/private unit.

Figure11: GPS data collection for decision support and control

Business and Stakeholders Protocols: Public sector and corporate sector has direct effect of administration of public dealing as discussed above. But the business and stakeholders are not directly controlled by the public administration. This sector can be under controlled using information technology by developing geospatial data collection apps. A controlled environment can be developed by implementation of Business and stake holder's protocol feasible for a smart city. The data
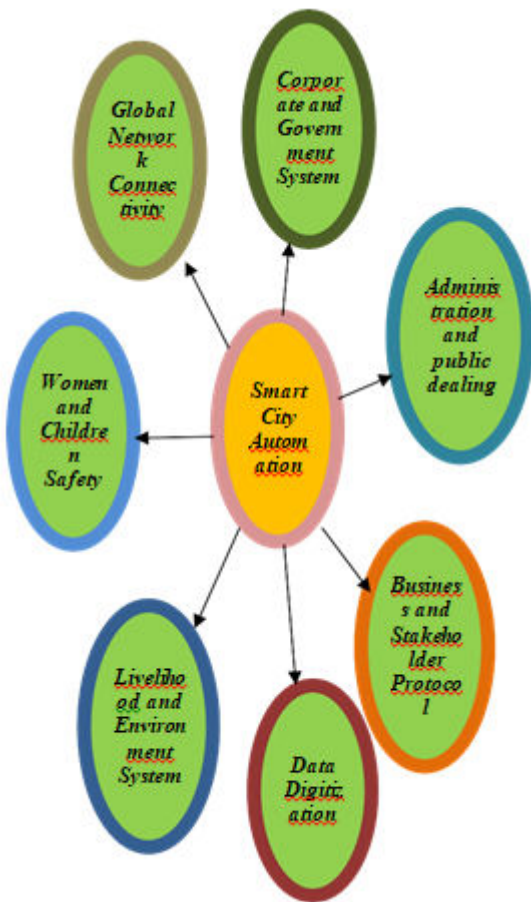
will get updated online every month on the server side by the stakeholder using Data collect.

Data Digitization: It is the major segment of IT and smart city. This segment is responsible for developing authorized data/ information collection/dissemination apps for public and administration ease and system automation. This includes digitization of land records, business records, banks, scientific records, educational records etc.

Livelihood and Environment Saving System: Food and Waste management, Water and its resource management, Pollution management include growing trees, Pedestal paths development, making the environment clean, hygienic and safe in all means. Developing the city as crime free zone. Healthy farming and vegetation with technology intervention and RS/GIS enabled tools can also support in smart development (fig.12). Improvement in environment is a challenge of hours. Our life style is polluting the environment (air, water and soil). It is the requirement of hours to adopt or develop such technology which can help to keep the environment clean. Education, transportation, sources of earning and basic needs of human life must be technologically empowered.

Figure12: Livelihood and environment saving

Women and Children Safety: Women and children can be protected with technology intervention like Artificial Intelligence.With the help of Android App and Artificial Intelligence technology with smart networking. Every women

and child would be a registered member of Protection Cell. They will mandatory bear an artificial intelligence device with GPS while going out. The device will also have the facility of alert to family and control room for rapid action. The Protection Cell control rooms will monitor them and an automatically operated Drone will provide protection coverage in suspected zones immediately. The Drone will have facility of high sound alarming to intimate and aware the people nearby region.

CONCLUSION

The paper is fully satisfying the objective of city automation system and big spatial data collection using android app development. Technology intervention can create a controlled environment of a city. It can enhance the sustainability of development. The paper describes the uses of big data collection app in various fields and its development. It also describes various new ideas that can help in the development of a smart city. It explain the need of technology intervention in Global network connectivity, business, livelihood, women and children safety, administration and public dealing, planning and record digitization etc.

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