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Artificial Intelligence driven Site Surveys and Inventory updates

Muhammad Fahad Athar

Kingdom of Saudi Arabia

Abstract: **In past few decades with the advent Integrated circuits (IC) the technology has massively improved and now Digitalization is the new buzz word with every potential process getting digitalized in telecommunications domain. Telecom service providers are spending a fortune in maintaining inventory records for telecommunication & Network Infrastructure. Furthermore, network infrastructure is subjected to constant upgrades and changes which increase the challenge of maintain accurate inventory records. Yes, the buzz word digitalization can support in implementing efficient process to capture and maintain accurate network Infrastructure. This document will outline the process of digitization of site surveys and inventory updates.**

Keywords: **Site Survey, Telecommunications, digitalization, Inventory Management System, Artificial Intelligence.**

I. INTRODUCTION

As humans we are marching towards better to best, the evolution in technology has seen an unprecedented growth in past few decades and with this growth new challenges and solutions are shaping our Information Technology industry. Also, growth in telecommunications sector has been enormous which is evident as connectivity is becoming more seamless with every passing day. Organization today are depending upon reliable telecommunication and network infrastructure to conduct their day to day business efficiently. Telco companies are required to optimize, upgrade and increase capacity of their network to meet these requirements, therefore its important to maintain network inventory records for proper planning and network realization.

II. BACKGROUND

Usually telco networks are spread across country wide with having multi-vendor and technology infrastructure connecting with each other along with various attributes for each kind of network, Equipment or node. In order to do a proper planning, there are two parts of information required (i)logical Information (ii)Physically available onsite Equipment. While the logical information can easily be seen from Network Management systems, [1] Some features that are usually discovered are: the nodes in a network, the connectivity between these nodes, the vendor types and capabilities for these nodes, the performance characteristics. While Physical Infrastructure is equally valuable in network planning for example this may involve capacity and geospatial check in physical inventory systems to ensure there is enough cable and passive equipment for service delivery.

III. PLANNING NETWORK DESIGN

In order to plan and design a well-organized design it is important to gather all kind information in networks such as logical and physicals. [2]A map can be used to represent the real things in the real world; for example, roads, buildings or Terrain information. GIS data can store roads, rivers, bridges in a digitize format, it is ideal for network planners to use it. Network planning with GIS data makes it easier to locate possible places through population density for Central Offices (COs) etc., as well as placements of pipes and lines for the communication infrastructure. Therefore, to maintain GIS based inventory system it is important to reflect and update all the physical network updates. While having said that doing site survey to maintain and update physical information can be costly and time consuming. To address this challenge modern technology such as Artificial intelligence and Machine learning can support to reduce operation cost of maintain physical inventory information.

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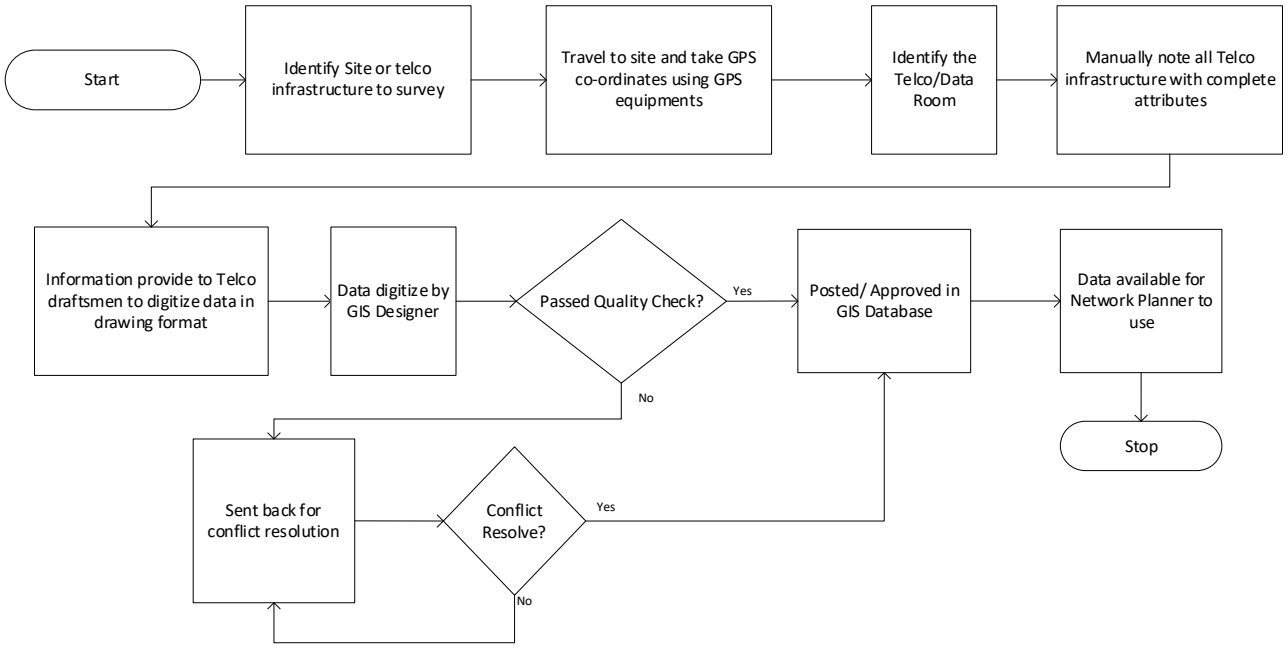
IV. SITE SURVEY AND INVENTORY UPDATES

As we are aware that Telco organization has extend networks country-wide connecting all corners of the country, this include Inside plant and outside plant infrastructure. Both kind of infrastructure have its own attribute that's plays pivotal role in planning green field or updating existing infrastructure.

The existing or conventional method of updating GIS inventory system is to site survey existing infrastructure. Conventional approach is that we conduct site survey in typical and old-fashioned way which is going to site and collecting information manual on paper which is last converted in to Computer aided drawings (CAD) and then only will be updated in GIS database. Once the database is fully updated network planners can utilize this information for service provisioning and design fulfilment.



V. PROPOSED SOLUTION

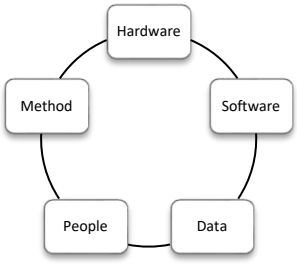
The issue with the conventional process of conducting sites visit is the Operational cost (OPEX) of organization, As previously mentioned we can reduce this overhead OPEX by utilizing the modern technology and innovations such as AI and ML. The solution proposed in this document will not only reduce the amount of time consumed and operational cost but will also enhance the overall process with automation and full inventory accuracy. Combining AI, ML and Geospatial technology we can automate the process of scanning Telco infrastructure and also automate the updates of Network Inventory system. The major components involving in this proposed solution is to have GIS database with Telco infrastructure and model builder library. Model builder is a library of virtual real-world telco objects such as Routers, Transmission, patch panels, fiber cables etc.

(a) Component of GIS: [3] The GIS system has mainly 5 Components (i)Hardware (ii)Software (iii)Data (iv)People and (v) methods.

i. Hardware: Includes 2 further components one is back end database which host the meta data of the GIS system and the other is user front end system which requires GIS software to run.

ii. Software: It provides the functions and tools needed to store, analyse and display geographic information. Key software components are

- Tools for the input and manipulation.
- A database management system (DBMS)



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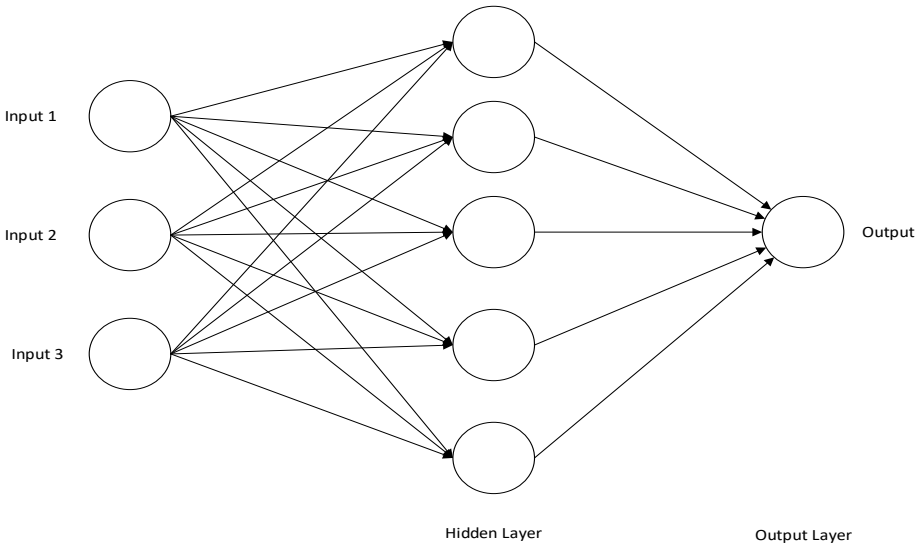
- Tools to support query, analysis and visualization.
- A geographical user interface (GUI) for easy access to tools.
- Model builder.

iii. Data: This is the most important component of the GIS ecosystem; The Geographic Data and related tabular data can be purchased from commercial data source or be built by organization.

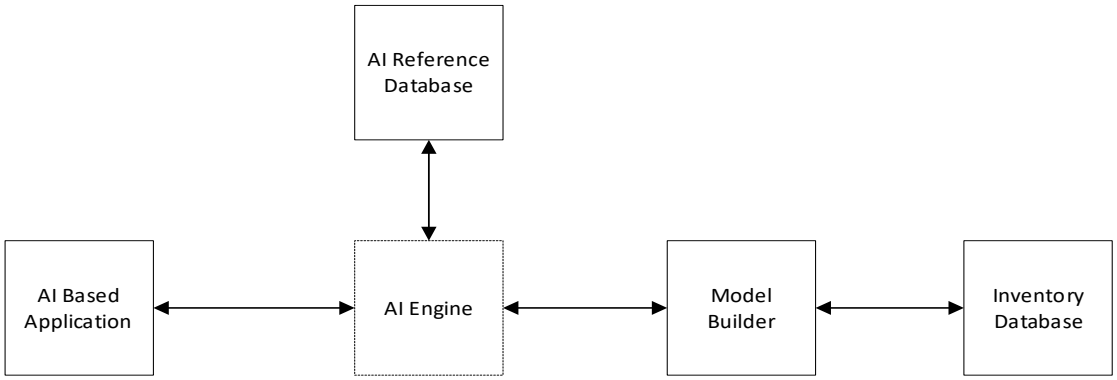
iv. People: The GIS users range from technical SMEs and data processor or designer who performs day to day operations.

v. Method/Business Model: This also consider to be the most important part in eco-system of the GIS, if we don't have proper business process, strategies and framework the data will eventual become outmoded.

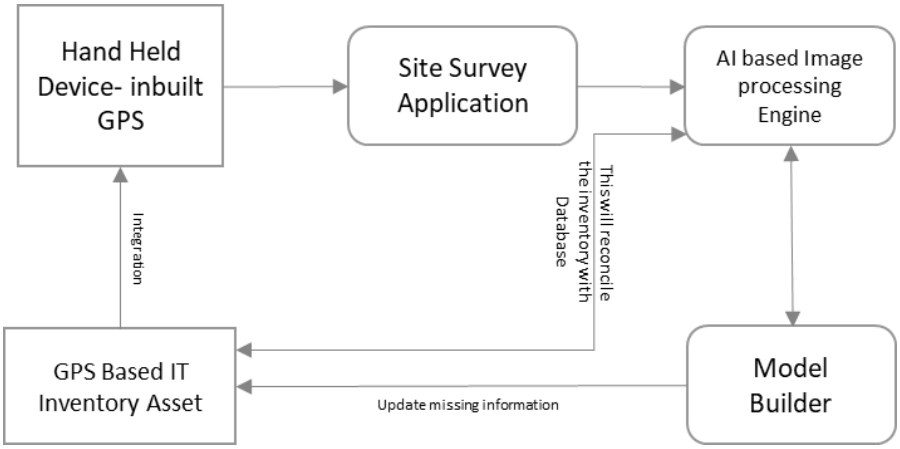
b. AI & ML: The new technology which is proposed to use is AI & ML image processing, Images from the site shall be used to detect the devices and Telco components in Database. Basically, Search and update inventory what you see at the site. The AI& ML dataset is required to be prepared for Telco devices, this dataset includes labels, dimensions, tags etc. [4] The dataset is consisting of images which are fed to neural Network and then trained on them. We use convolutional neural network; such type of networks is based on pooling layers in addition to Multi-perceptron layers (MLP). Below is a typical example



The proposed idea is based on the above two components, The AI & ML application able to connect to AI Database for identification. Upon reaching site the GPS enabled device will automatically detect location device hence connecting existing for validation and update. The application using AI will detect the attributes of the device and telecom room and reconcile with existing data and will filter the missing devices and update inventory system database. This automatic detection and reconciliation will not only simplify the process but also reduce the OPEX of telco organization.



This solution can be utilized during preventive or parodic maintenance to ensure and guarantee the accuracy of the inventory system. Furthermore, the Change management process can be integrated to Change Management system to certify that required inventory has been properly updated in system. The solution will actually reduce the required OPEX consumed by Telecom and large organization in managing their Infrastructure records.



VI. CONCLUSION

In conclusion the paper highlights an effective and systematic approach to use artificial intelligent and geospatial inventory system, from the above it is evident that conventional methodology of maintain accuracy and updates in inventory system is increasing the operational cost of telco organization while if we utilize the artificial intelligence, machine learning and geospatial technology will reduce the operational cost while overall simplifying the procedure for site survey and updating inventory system.

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