

Design of Smart Facility Management System

RR Karthikeyan¹, Dr. B Raghu²

¹Research Scholar, Bharath Institute of Higher Education and Research, Chennai Tamil Nadu India

²Principal of SVS Group of Institutions, Warangal, Telangana India

¹rrkarthikeyan0711@gmail.com

²raghubalraj@gmail.com

Abstract:

This paper is analyzing the traditional facility management system to manage the facilities with huge amount of people who are working for a different departments for the same organization. Space management, space utilization, move management, and asset management are critical functionalities managed and monitored via this system. Due to some limitations and legacy nature of these systems, there is a need for the Integrated Work Place Management System (IWMS) to handle real estate, facility, and space and Capital Management system collectively. Proposed system is to design the single Workplace Management system for all the workplace need. Detailed comparative study was done with advanced IWMS and legacy facility management.

Keywords: IWMS, Facility Management, Space Utilization, Smart Workplace Management, BIM Design

I. Introduction to traditional Facility Management - CAFM System

Computer Aided Facility Management (CAFM) is the special software platform for facility management to track the real estate space utilization, space allocation, Move management and asset tracking. CAFM schedules the maintenance tasks and track the work orders with service providers. With the help of other technologies like CAD (Computer Aided Design) and BIM (Building Information System), facility management tasks can be closely monitored with the help of CAD floor plan and BIM information system for asset management. Response time is calculated between the time defect has occurred and a repair being carried out.

Facility users inform CAFM customer executive through phone or web portal and the CAFM executive create and assign the request to concern team. Systems are not inter connected in CAFM.

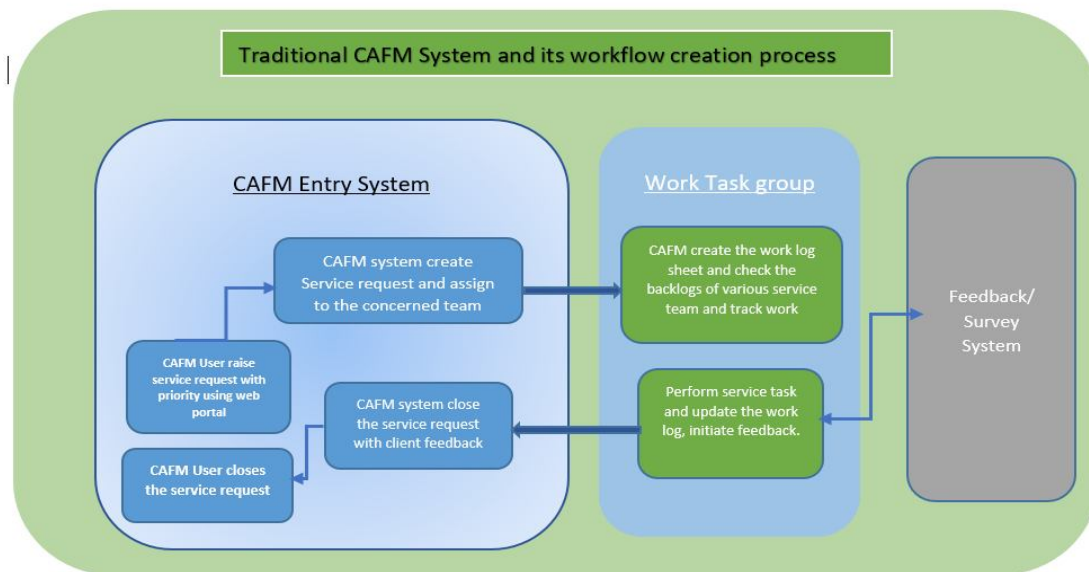


Fig. 1. Traditional CAFM system – Over all process design

II. Limitation in Traditional Facility Management system

Since the data coming from various streams such as work groups who performs the physical works, software applications controlled by IT help desk which receive the tickets from the end user of the FM applications, system users who assign and changes status of the service tickets by tracking the assigned work to a particular team after checking the workload of a particular team, traditional FM applications sometimes fails in accessing and controlling the correctness of the work tasks. These FM systems maintaining the building life cycle without an automated mechanism to synchronize the data coming from various streams.

III. Absence of virtual reality systems with 3D Designs

Since the Traditional CAFM systems are maintaining the floor plans with legacy representations about the work spaces, meeting rooms and parking areas with assets like HVAC (Heating ventilations and air-conditioning) systems, Chillers, and AHU layouts as 2D models. With these merely the space management related activities can be done.

Building Information Models (BIM) with 3D visualization is enhancing the CAFM capability to big extend by maintaining the Asset Database by maintaining the purchase history for any key component replacements, service plan schedules and warranty information's.

3D BIM managing the all the information's and integrate the geometrical information along with the latest technological.

IV. Proposed Smart Facility Management system

It Supports the planning, design and management of an all the work place needs of an organization. Also it helps to optimize the use and administration of workplace resources and communicates that information, via a well-planned request management process, to the required organization stakeholders.

The key need of IWMS is that allows the user to communicate the required information across the entire organization stakeholders, without limiting the distribution of information to those beyond particular module or management system.

An Integrated Workplace Management System (IWMS) that helps organizations optimize the use of workplace IBM TRIRIGA features critical-path dependencies

resources, including the management of a company's real estate portfolio, facility management which deals with infrastructure and facilities assets.

A. Real Estate Management

It helps in planning the strategies and goals of the real estate portfolio. Planning involves whether to purchase or lease a new property by its terms and conditions. For each scenario of the planning, it can assemble one or more project transactions to represent a potential real estate solution. Types includes acquisition, disposition, expiration, termination, lease and sublease.

B. Lease Accounting

IBM TRIRIGA is a comprehensive and easily configurable system that helps organizations streamline and automate their lease accounting processes from the initial data import to ongoing audit and compliance reporting.

Leasing module maintaining the land documents to know the property rights such as lease, easement, deeds, options and legal rights.

This module maintaining the monthly, quarterly payable and receivable to maintain the payment history. All lease contracts kept at centralized database to enable proper assessment, classification, accounting, and reporting.

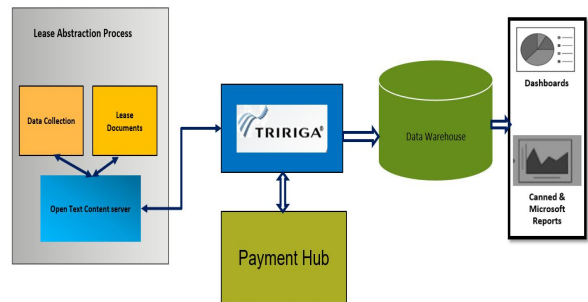


Fig. 2. System overview –Lease Module

C. Capital Projects:

This module deals with following critical metrics of the construction of any facility:

1. Construction Program management.
2. Scope, Fund and Cost Management.
3. Schedule and vendor management.

that predict downstream impact of upstream schedule changes. This focuses resources to deliver programs

And projects on-time. Project manager who is owner of the project can check various dash boards to know the status, completion status, financial forecast, and revenue of the project.

D. Space Management

The management of the space can be achieved using the preferred roles. The feature includes planning the space and utilization of those spaces. This space structure includes Property, Building, Floor, and Space. Allocation of the specific area in the floor or the entire building to the particular department in the organization are managed in space management. Charge backs and occupancy status are the main area to track the operational cost.

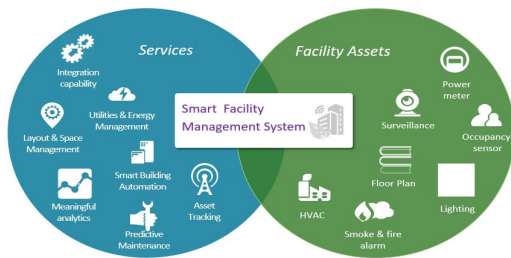


Fig. 3. Smart Facility – representative Model
BIM connector is used to integrate 3D floor models

Floor diagrams are designed in CAD model and integrated with TRIRIGA using AutoCAD Integrator.

To convert the Auto CAD file (.dwg) in to 3D BIM model, Record file or Master file and Master file with furniture, fire and other important layers with area measurements are inputs to the Revit system.

In to TRIRIGA and BIM Model management support more visualization and realization of 3D spaces.

V. Designing the portfolio hierarchies for Smart Facility Management System

Designing the portfolio for the given facility is the first and important step to derive the hierarchy of the facility Management system. Below are the various portfolio hierarchies maintained by IWMS.

Geography hierarchy is explaining the users to understand where the facility is located. Ex In which city, state, and country of the world. From the location anyone can understand the location of the space from the location hierarchy. Organization hierarchy shows the various department of the organization to which the facility is allocated. People are the employees and consultants (Contractors) working for the specific organization.

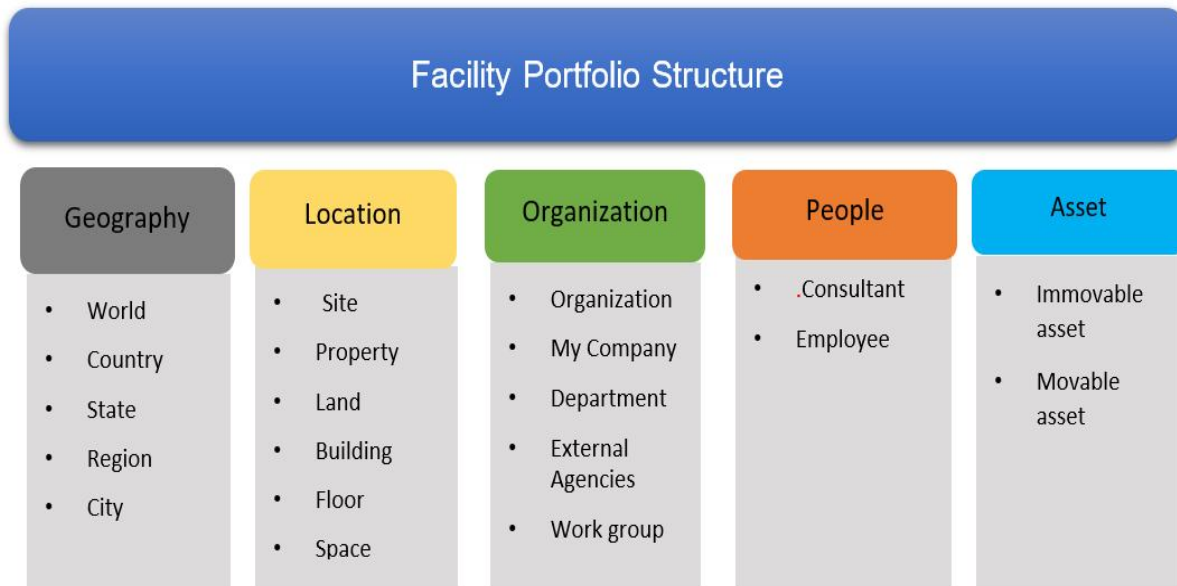


Fig. 3. Facility portfolio structure of the smart facility management System

VI. Important roles in the Space and Move Management

A. Facility Administrator/Manager:

Primary responsible person for all the facility related operations like allocating spaces to the various space owners like project directors, asset management, strategic facility planning and monitoring the overall facility operations. He is also responsible for all social responsibilities of organization including sustainability.

B. Move Planners:

Responsible person who is involved in planning space moves based on the increasing size of the departments or due to various internal reasons of the organization. Move planner will initiate the communication about the move to the various department and take care of all the stages of move management. Generally various move management tools can be utilized to schedule the moves, all departments and those team members should be intimated via e-mail notification to have better tracking of move status.

C. Space and Move Approver:

Space approver is an authority to approve the move requests from various departments. He can check the various move requests and validate the space requested.

If the particular space is restricted to one particular team, then he will not approve the space to any other team. Move approver should inform system administrator on the various system level securities and access rights for each group in the team.

D. Drawing coordinator (CAD):

Drawing coordinator is the in charge of maintaining the various CAD diagrams or BIM models for all the floors in the facility. Various layouts of HAVC, AHU, and refrigeration system are also maintained by drawing coordinator.

VII. Move Process

Employees or contractors movements from one location to another location within in the organization is planned and tracked with the help of move process. Move planner who is planning the move requests for the all the existing employees or new hires should have proper move approval workflow to get the approval from move manager for each or group move.

Move request is raised with “Someone else” option by move planner and reason for the move any one of the following:

Job change, Department change, others.

Details of the move request is provided in the description field to understand the purpose of move, Asset details are populated in move line item (MLI), and the move line item is closed when move request is completed. In simple or large moves, equipment’s can be checked-in with the MLI for tracking purpose to know what all are the people’s assets are moved with that specific move requests.

Ex: Docking station, phone, desktop/laptop, KVM Switch.

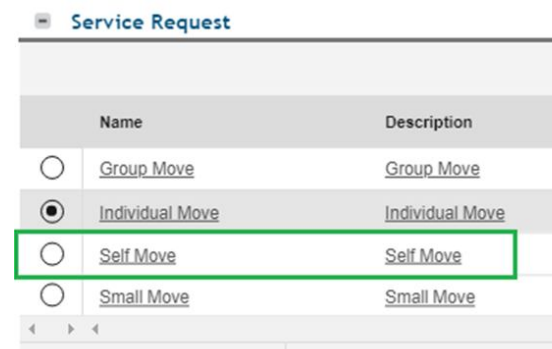


Fig. 4. Snapshot of various move request type

Locate person or Meeting Room:

With this feature any person from the same organization whoever is having the valid access to the IWMS system can locate any person and his seat details. Floor plan in auto CAD software is used for creating the complete floor plan with the space details such meeting rooms, work stations and other common areas like steps, lifts, and rest rooms.

Similarly an user of an IWMS can search for any meeting room in a specific floor to book in advance for his meeting needs along with the necessary equipment.

With the locate app, we can search any key rooms like conference rooms, training, medical, break rooms.

A. Steps involved in 3D Conversion in Revit

1. Selection of architecture template in Revit.
2. Setting Project Unit.
3. Creation of walls.
4. Selection of respective Level.
5. Linking the cleaned 2D drawing to the Revit.
6. Creation of floor plan with Walls, Columns, Slab, Doors, and Windows or any other Components.
7. Applying Materials & Paints to the 3D BIM model.
8. Creating polyline on the various room areas and tagging the rooms to the specific space.
9. Upload 3D BIM model to the respective building with IBM TRIRIGA and set parameters by using BIM Connector.
10. Using Navisworks plugin the 3D BIM model can be visualized.
11. 3D Model can be uploaded in to NWC format.

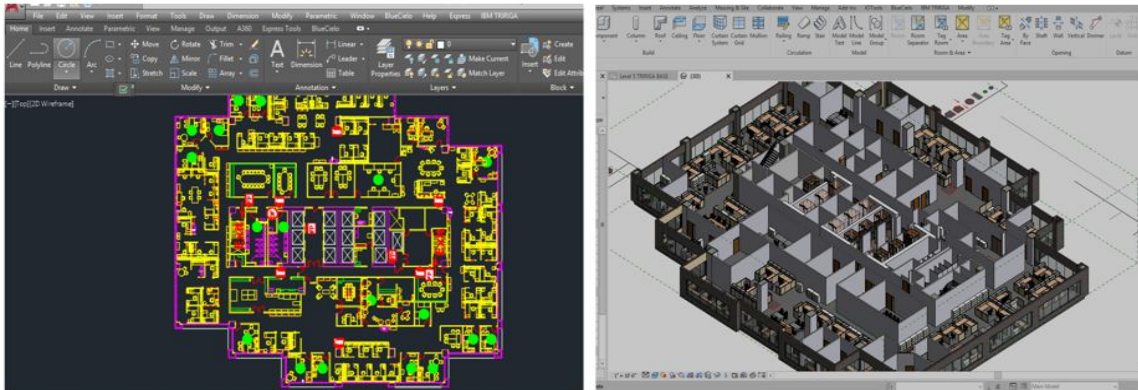


Fig. 7. 2D Top view in CAD software and 3D Top view in Revit system - the facilities' floor plan

B. Steps involved in attaching 3D model to IBM TRIRIGA System

1. Open BIM Model Management Tool in IBM TRIRIGA application.
2. Create a bucket in Autodesk forge by using Autodesk Forge Client ID & Client secret.
3. Upload 3D BIM model in the respective building by using bucket.
4. 3D BIM model can be visualized in IBM TRIRIGA.

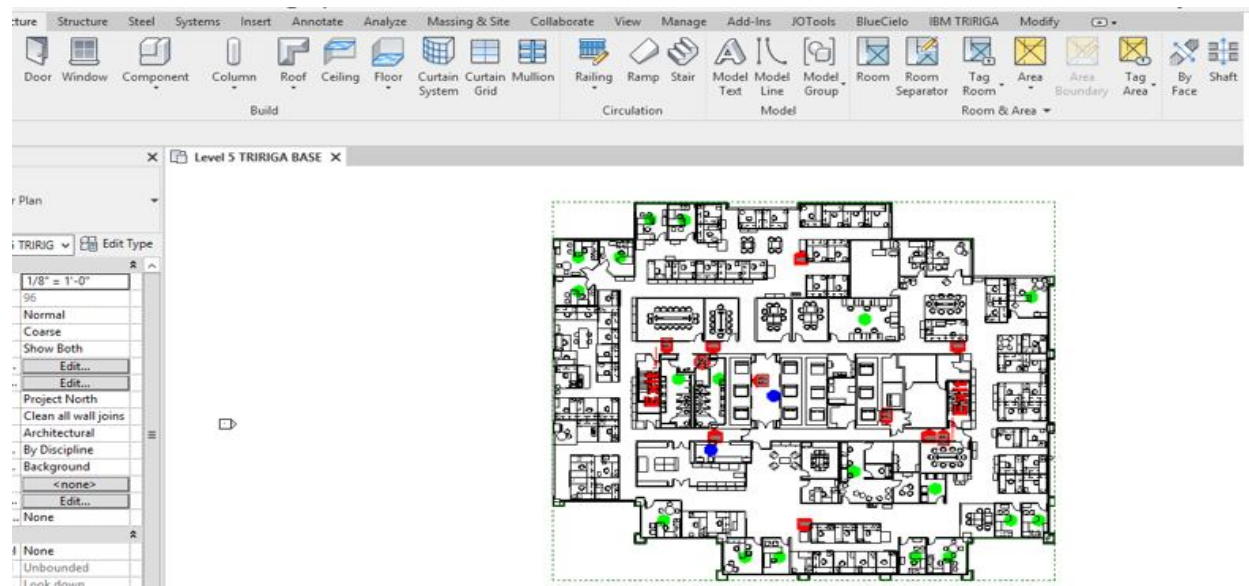


Fig. 8. Perceptive view of the building floor plan in Revit system

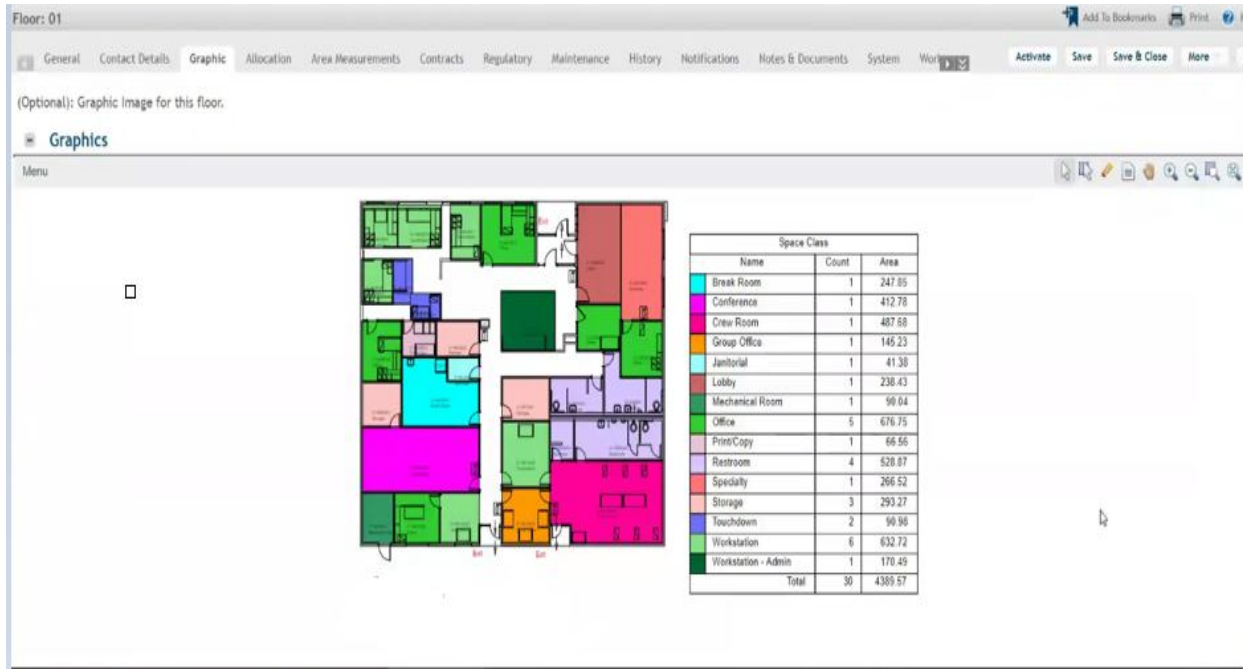


Fig. 8. Floor plan -graphic page of TRIRIGA System

IX. Proactive approach for Asset Management

The log file from an IWMS contains the data of every request such Work order details, priority, reported date, targeted and actual finish date. Developing some insights on manpower efficiency, total tasks completed per day, response rate for each priority, trends on service response time will provide the base for planned preventive maintenance tasks.

Smart facilities adopts predictive analytics model for maintenance activities. This proactive approach will be based on the actual condition of the equipment's and not based on some calendar schedule. Future performance or likelihood of failure of the device or equipment is monitored by key sensor readings.

X. Automated Asset Management using BIM Models

BIM Models linked with an external database to save the following types of data is a key for automated asset management system

Identification data of assets: This data uniquely identify the asset by its code, type, model, and description. Company information of the manufacturer information saved along with this.

Technical Data: Technical sheet, data sheet, installation guide and any other technical specifications are saved.

Maintenance Data: Past and future schedules, contract details of service level agreements along with the site visit details are saved. Any videos to help maintenance operator during the service repair operations saved in this type of data.

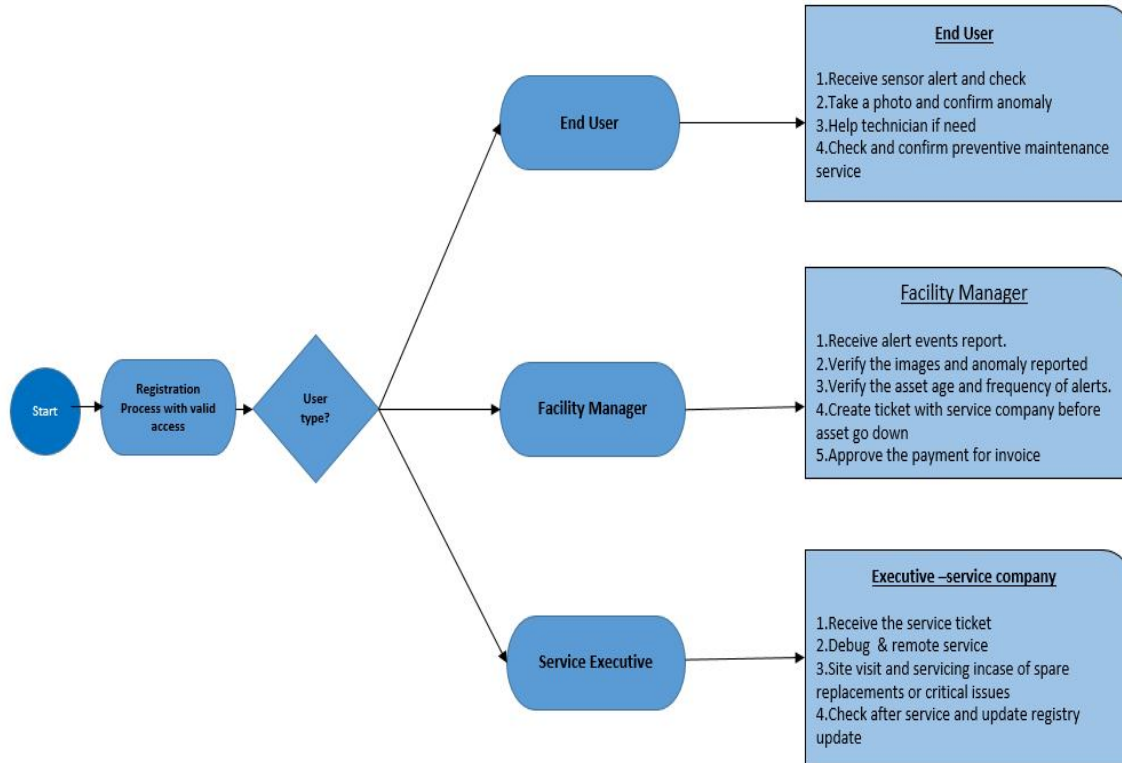


Fig. 9. Automated work order management – user activities & responsibility

XI. Conclusion

To overcome the limitations in legacy CAFM system, proposed solution is designed with the help of IBM TRIRIGA system. This solution can handle any activities of Real Estate Management, Facility Management, and Capital Project Management.

Implementation cover functionalities of space management activities with 3D BIM models and outlining the asset management. Real Estate modules Management which deals with leases and other real estate activities are explained in detail with but they are part of the integrated workplace management system. Asset portfolio details such as purchase history and maintenance schedule can be combined along with sensor data to identify the exact health of the equipment's. Smart facility can have optimized asset utilization, increased life cycle, using proactive maintenance, repair services can be effectively managed.

There are other IWMS and BIM software's are available in the market for implementation. IBM TRIRIGA and Revit software's are used. In this solution approach.

XII. Future Scope

For smart facility is necessary to have sufficient number technical staffs to continuously monitor the sensor readings via dashboards and support applications to track the health of the equipment's. For better utilization of spaces in facility, it is recommended to have strategical space planning in place to reduce the cost and increase the space utilization by moving the people from over-utilized place to underutilized place.

Automated worker orders to handle the facility maintenance activities and asset management including predictive maintenance with the help of building management system is the critical activities before we implement IWMS in a facility.

Combination of IWMS deployed in the cloud platform as a SaaS, BMS system which collect the facility moments and save those in NoSQL database in the facility cloud platform will boost the performance of smart facilities with efficient emergency monitoring system along with advanced facility management system like TRIRIGA.

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