

## **Designing and Developing a Computerized Medical Gear's Recording System**

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### **Abstract**

**Aim:** The research targets at designing and implementing a computerized biomedical equipment's inventory management system at an Indian private hospital set up.

**Objectives:** 1. To develop different modules of the application like login module, database module, business logic module, client/customer module. 2. To perform unit test cases and check the working of the system.

**Methodology:** The application is designed and established using python version no. 3.7 and visual studio. Constructed on the need and requirement analysis, the software application was created. Modules, methods and template viewsets for adding the product details, updating/editing function, recovering the product as per end-user needs and for destroying the product field entry from the databank was incorporated. The submission caters to the needs of the medical devices distributors, manufacturers and in the hospitals for inventory management purpose. Front end handshaking module was coded. An in built catalog, SQLite has been incorporated for the application data recording, so that the speed of data retrieval from database becomes faster. The software facilitates gathering of essential information and documents related to medical devices in healthcare institutions.

**Tools used:** Python 3.7, SQLite inbuilt database, IDE pycharm visual studio 3.7.4, Tkinter library & MVC architecture (Model, View, Controller)

**Testing:** Unit test cases were made for all the modules. Classes and methods were functioning correctly. Minor errors were debugged and rectified ensuring reliability of the software application.

**Results:** The desktop application software is helpful for the allied healthcare professionals, students, healthcare technicians, inventory managers, etc.

**Conclusion:** The application has successfully addressed & satisfied the inventory management problems at an hospital setup..

**Key words:** Healthcare IT application, biomedical inventory management system, allied healthcare applications.

### **Introduction**

With sophisticated technology and changing work culture, requirements of highly accurate, safe, reliable and user-friendly medical device has become very important. The end user of these medical devices is challenged for in maintaining, calibrating and servicing the

instrument. To ensure accurate performance of medical devices, healthcare professionals carry out regular preventative maintenance and safety precautionary investigations. Global directives from IEC, ISO 10993-1 and MDD 93, outline as to how testing and maintenance must be performed for medical electrical equipment and systems (1). On healthcare, medical electrical equipment management system focuses on the ultimate success of entrepreneurship. It is an emerging research area for achieving higher profit margins, lowering inventory cost and a prerequisite information for decision making related to location, storage, planning, budgeting, and resource allocation. Inventory management system must not only focus on *the profit generation model*, but must also provide ease of high quality inventory access *and patient care*.(2)

Recently, the demand sophisticated diagnostic systems in the healthcare sector is growing rapidly. The greatest challenge for biomedical supply chain system is to manage inventories proficiently and at the same time maintain a satisfactory level of healthcare services. To satisfy the increased demand for healthcare services, supply chain authorities need to find effectual and effective ways of improving and maximizing the registers. In addition, the fragile and throwaway products of several medical produces have been most important challenges in handling the stock details in healthcare division. Currently operational performances and disputes in health care section between various stakeholders are directly related to inventory management problem (3). These problems can be reduced by implementing automated recording system(4). The automatic system can provide data entry, computation and report generation services for the end user(5)(6). Although, the system provides helpful services but it possess higher initial and annual computerised maintenance costs(7). Another benefit of an automated system with intelligence thinking capability recognize, analyse and propose solution to input problem statement(8)(9). On a larger scale deployment of internet of thinking capability, embedded components and computerised system intelligence will bring about smart and efficient inventory utilization for better healthcare delivery(10)(11)(12).

The paper presents software solution for tracing, inspecting and managing medical devices inventory system for civic and private healthcare organizations. The software can be installed and assessed on a locally, without the need for cloud based or WiFi (Wireless Fidelity) support. Professionals using the software must have login credentials i.e., username & password, which will ensure confidentiality of the crucial medical device inspection data.

Record administration framework is basic for guaranteeing quality control in businesses that handle exchanges revolving around shopper goods (4). A good system of inventory management alerts the trader for registration. Inventory management method provides an substantial means to manage large shipments automatically (4).

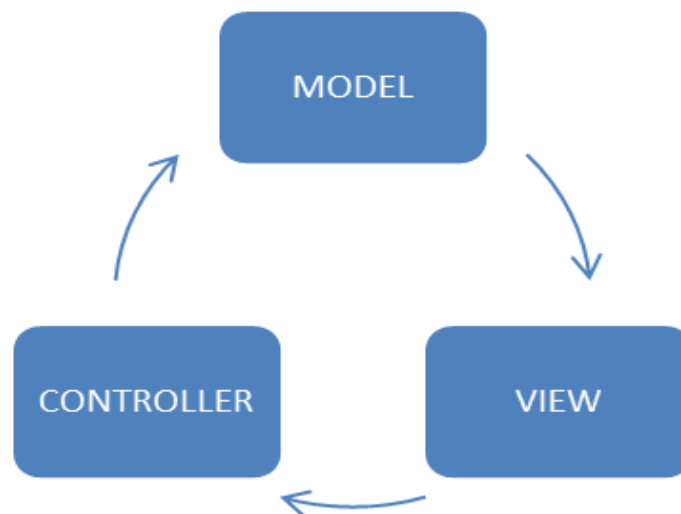
The application module can compare prices and give decisions as to which new item/device are to be purchased in the hospital. The application will be used by the purchasing division of the hospitals for the procurement or comparison of costs, by biomedical engineers for repair, medical device services and by companies for stock tracking.

The application includes broad organizational outline, details of the sales, particulars of the inventory and the residual stock provided by the organization. There is also provision for updating/editing the database. This form also includes the stock balance remaining and details of the transaction balance.

### **Architecture and method**

The system was developed in 3 tiers i.e. Client, business & data tier. The client tier or the front end of the system is implemented using the Tkinter library of python application. Its main purpose is to provide the user friendly display access to the end user client. The application display consists of various buttons firing a particular event/function in the model.

The business tier consists of the business logic related to inventory management. It is the middlemost layer, which establishes connectivity with the database and generates queries. MYSQL database tier or data layer establishes a link between the database and business logic module. The database consists of various tables having primary key, foreign keys and back references for identifying interrelations between the stored content. SQL queries fired in mysql database retrieves/updates the data stored in the database. Characteristic features of sqlite/mysql database are reliable (providing rich security), confidentiality (protects the data) and integrity (encryption capability) of the stored data. Adding a new medical device includes the enrolling id of the device, its manufacturer details, model number, serial number, type of equipment, purchase date, etc.(13)



**Figure 1:** MVC model implementation

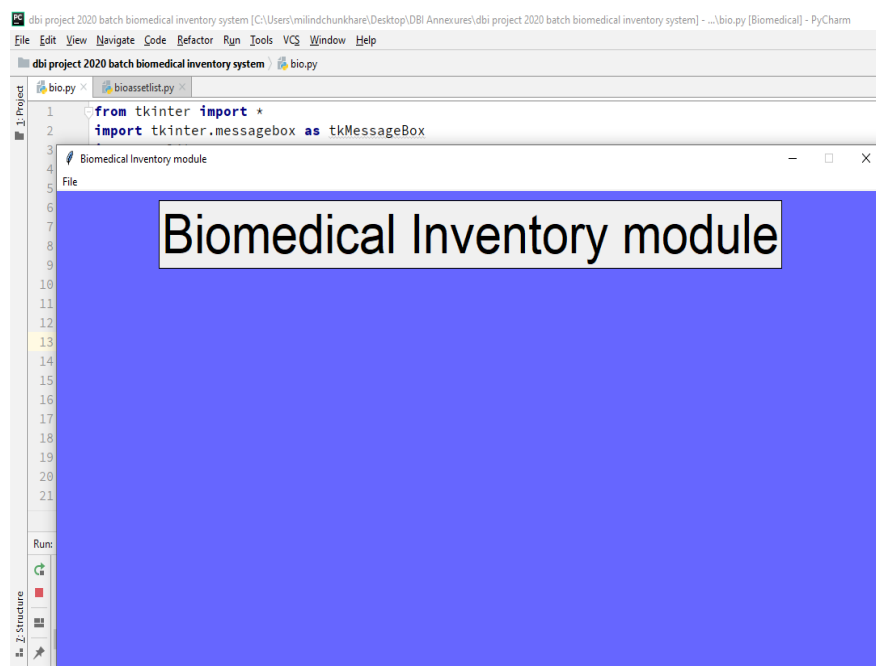
The software solution developed for inventory management provides ease of searching and tracking a medical equipment. It generates alerts for servicing/maintenance schedules. Other features include displaying of the essential details of stock, amount balance information and transaction management.

Testing was performed to check the capability and reliability of the codes. The proper working of the application was ensured during create, update, edit, read, delete /remove operations of the product entry. Unit test cases were implemented and bugs were removed.

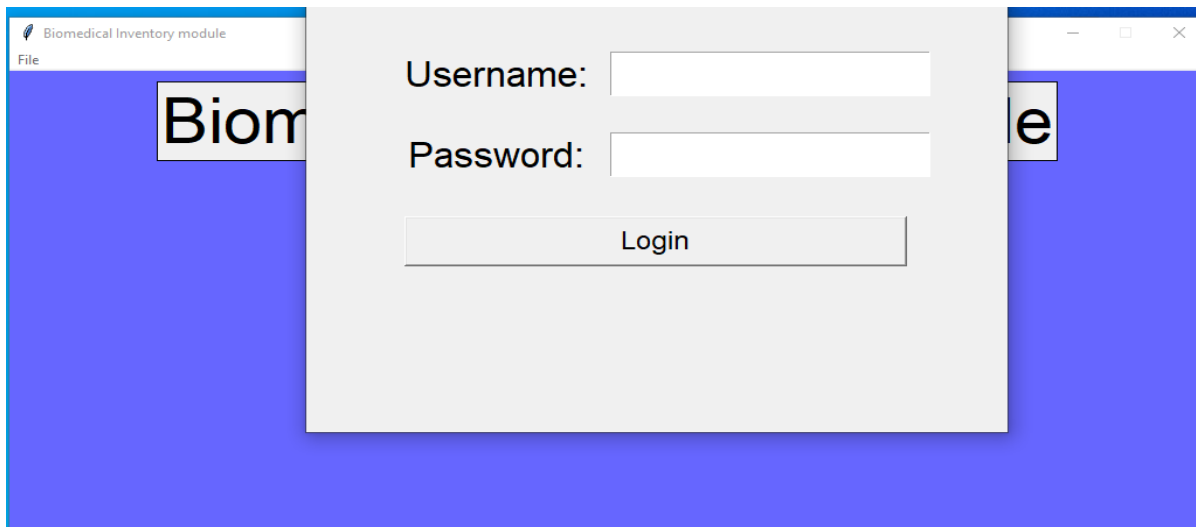
Other details like annual maintenance contract (AMC), comprehensive maintenance contract (CMC) details, manufacturing date, lifetime of the equipment, equipment consumption, formulation of depreciation, equipment kit condemnation can be added to the system.

## Results and discussion

The system is designed, tested and validated during early months of 2020. Head of biomedical engineering department/inventory manager who is responsible for technical events is authorized as administrator of the software system. The graphical outline of the application is shown in Fig. 1. Moreover having perception about equipment inventory the application provides a library of relevant information related to medical device regulations, standards for device maintenance and servicing, notifications, forms and FAQ questionnaire. These can be downloaded as well in the PDF format. Medical devices inspection report & form can be filled and downloaded from the application. Also there is a tremendous increase in the user login statistics of the application. The statistical information shows how this technology is adapted and needed for the incorporating automation in healthcare service delivery management. Healthcare applications are also implemented in disease management for diseases like Alzheimer, stress detection, asthma, tuberculosis, etc.(1). ISO / IEC 9126 Quality Assurance Framework specifies the application quality model. It describes the software quality in six groups based on the software characteristics concerned.(1)

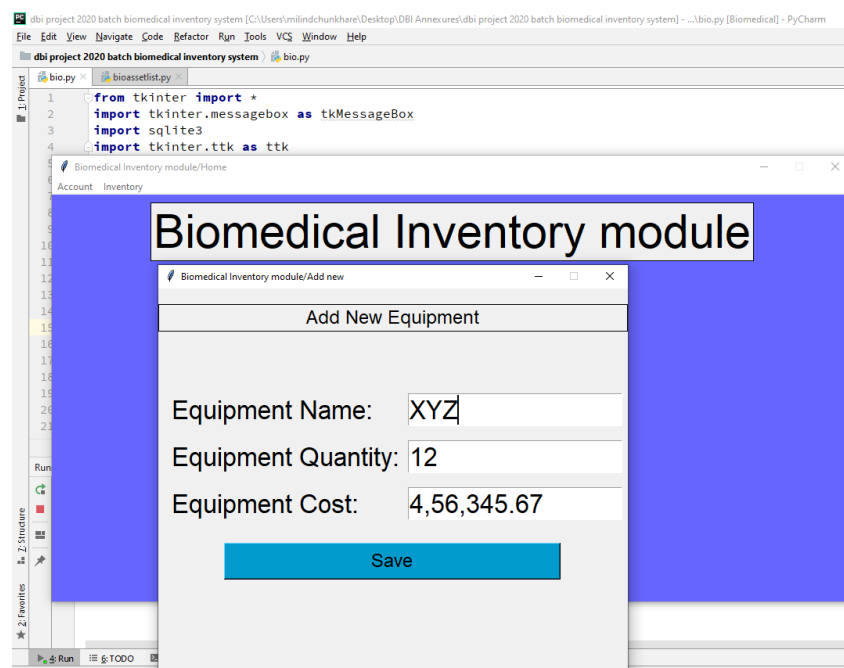


**Figure 2: Home Page of ‘Biomedical Inventory Management System’.**

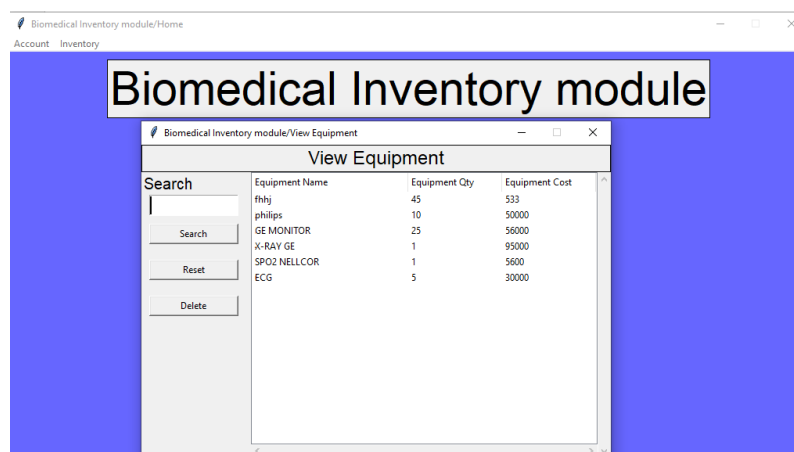


**Figure 3: Front end “login module”**

One opinion about usage of the application module is that the data gets effortlessly accessed on a mouse click. Searching & editing of the medical equipment details like name, price, becomes easily as we hunt for a specific field within the model. Security, confidentiality, integrity and ease of access are key qualities of this application. Security authentication is facilitated by user login credential feature, token requirement for application access and control over recording. Healthcare professional can only access the information if he possess the username and password for the application. Simplicity in design and logical graphical implementation has made comfy access to the functionalities of the application. The communication message are concise, clear, transparent and straightforward. Very few steps are needed in all the procedures.



**Figure 4: Creating/Inserting of the New medical equipment details into the SQLite database.**



**Figure 5: The “View module” displaying the retrieved information from the database with search and delete options.**

## Conclusions

The application is the primary automated digital catalog for medical equipment's. It strengthens the running of healthcare institutes & medical devices strategies by offering comprehensive data about make, cost, history of the machine and performance of a medical devices. It also gives inspection status information of the medical equipment's. The technical staff will evaluate the performance results and use this knowledge to conduct preventive maintenance in order to provide society with more and more efficient healthcare services.

Maintenance methodologies and unwavering quality of medical gadgets have been increased in healthcare organizations where automation and paper less investigation practices is conducted occasionally that prompts conveyance of better health services to the end user. The implementation of this application is absolutely free and it doesn't need extra capital for its complete utilization. Paperless practices can be possible by integrating this system into their work procedures and making its use for all day-to-day activities.

**Compliance with ethical requirements:** Yes

**Conflict Of Interest:** None

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