



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 4, April 2024

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

 9940 572 462

 6381 907 438

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 www.ijirset.com

Develop a Program Design and Coding Standard

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ABSTRACT: The use of programming language is increasing in the real world in all domains. So it's important to follow and maintain coding guidelines & standard and follow the best practice. This article gives an overview of naming & coding standard, use of it, comparison of the main features of different programming languages(C++, Java, Python), data management approaches for local, mobile and cloud solutions for ERP and EHR implementations, the structure of each proposed algorithm and use, Few examples for in-house development, ERP solutions, packaged software implementations, and mobile applications, few proposals, and recommendations for further research. Also explain how to create the corporate standards a sample database and application design and development.

KEYWORDS: C++, Java, Python, coding standard, ERP, DES and AES

I. INTRODUCTION

Software development companies always want to maintain well-defined coding standards. Every company have their own guidelines and follow coding standards including naming conversion, error handling mechanism, reprocess failed transaction depends on the domain, programming language, and other protocols. All programmers should follow and maintain the coding standards, so code will be approved by management during code review, and later in case of any enhancement, it will be easy to upgrade code without an original programmer.

II. THE GOAL OF HAVING CODING STANDARDS

Coding standard helps to reduce code complexity, improve code readability, understandability, maintainability, detect error and increase code efficiency. A few coding standards will be explained in this article. **(a). Standard headers and comments for different modules:** All the code must contain the Header, name of each module, author name, and date, change request history, and version details, which variable is used for what purpose (local/global variables). Comments should be written in each step to understand the coding logic. **(b). Naming conventions for local, global variables, constants, class and functions:** It is important to understand each module and the use of each module, for example, if this is related to student, the Class name should be a student (for example StudentResult, StudentReport, etc), Local variables, the function must be written using camel case letter (for example 'localData') and Global variables must start with a capital letter (for example 'GlobalData'). **(c). Use Try -catch block to write any code:** It is recommended to use a try-catch block to write any code including simple or complex logic. so in case of any error, the code will move to catch block and display the error details. It will be easy to understand the error during debugging. **(d). Length of functions:** The function should be written with multiple small task or function to avoid the complexity of the code. **(e). Select correct programming language:** This is important to select a correct and user-friendly programming language, it's recommended to use the latest programming language which supports cloud, data encryption, and other multiple advanced features [1].

III. ADVANTAGE USING CODING STANDARD

This is important to maintain coding standards for efficient code design and implementation.

i) Coding guideline and standards always increase the products including the efficiency of the software, reduce development time, the complexity of code.



- ii) Try-Catch mechanism helps to detect and analyze the error in each step that reduces time and extra cost for maintenance.
- iii) Easy to hand over to another team member in case the programmer wants to move some other team/project.
- iv) Maintain & Manage Software version and revision control increase code readability and understandability, which helps to upgrade project in the future [1].

IV. NAMING AND CODING STANDARDS BASED ON THE PROGRAMING LANGUAGE RECOMMENDATIONS

Each programming language has its own naming and coding standards. But the main concept is the same for all programming languages. For example, “//” is used to write any comments in Java, where “#” is used to write comments in Python. Python naming and coding standards with one code example will be explained here.

- i) Packages, Module, Global Variables, Function: It should be all lower case and an underscore can be used for multiple words.
- ii) Classes: It should be UpperCaseCamelCase convention.
- iii) Instance Variables, Methods: It should be all lower case and an underscore can be used for multiple words. a single underscore is used for Non-public instance variables.
- iv) Method Arguments: the first argument named ‘self’ should be there in Instance methods and the first argument named ‘cls’ should be there in Class methods.
- v) Constants: It should be fully capitalized, and an underscore can be used for multiple words [2].

check Palindrome in Python Code

```
def check_palindrome(string):           # function name describe it's for palindrome check
    reversed_string = string[::-1]     # Palindrome can be a string or number
    result=1                            # variable declaration with 1
    if(string!=reversed_string):
        result=0
    return result                       # It will return result
string = input("Enter the String or Number: ")
result= check_palindrome(string)
if(result):
    print("It is a palindrome")
else:
    print("It is not a palindrome")
```

Output:

Enter the String or Number: 675
It is not a palindrome

Enter the String or Number: Mam
It is not a palindrome # its case sensitive ,so Mam is not palindrome, but MAM is palindrome

Enter the String or Number: MAM
It is a palindrome



V. COMPARISON OF THE MAIN FEATURES -C++, JAVA, PYTHON

Factor	C++	Java	Python
Multiple Inheritance	Support both single and multiple inheritance	Support single inheritance and Multiple inheritance is partially done through interfaces	Support both single and multiple inheritance
Operator overloading	Supports Operator overloading	Does not support Operator Overloading	Supports Operator overloading
Thread Support	Does Not support threads	Has in build multithreading support	Supports multithreading
Use of functions and variables	Functions and variables are used outside the class	Every bit of code is inside a class.	Functions and variables can be declared and used outside the class.
Speed of execution	It is a fast compiling and Third Generation Languages(3GL) programming language	Java Program compiler a bit slower than C++ and Third Generation Languages(3GL) programming language	Due to the use of interpreter execution is slower and Fourth Generation Language (4GL) programming language
License cost: It depends on what all component, a company wants to use, year of use, number of projects etc.	The material that a company own, grant a worldwide non-exclusive irrevocable transferable royalty-free license to display, produce, execute, deliver, and create derivative works for commercial or non-commercial use (Terms of Use (n.d). Retrieved from https://isocpp.org/home/terms-of-use).	Personal users will be able to use Java for free, but if Java is being used in a commercial or real environment then a license needs to be purchased (Rabett, 2019)	All Python licenses, unlike the General Public License (GPL) allows, company distributes a modified version without making any open-source changes (History and License (n.d). Retrieved from https://docs.python.org/3/license.html).
Library support	Has a limited number of library support	Has library support for many concepts like User Interface (UI)	Has a huge set of libraries that make it fit for Artificial intelligence (AI), Data Science, etc.

VI. WHAT IS DATA MANAGEMENT

Data management is important to organize, arrange original data, utilize memory space, handle CPU speed, and increased computer performance. The data could be either integer, float, character, string, binary data, or a combination of all based on how the materials are used in a field. Data management is similar to what a librarian does in a library, to organize the book into a particular form, so it's easy to find any book. Data structure and algorithm helps to manage data and build an organized data management system [3]. Data management is used in every field, from student records to employee history, patient records, etc. It is required in all platform - On-premise, local, mobile, cloud, etc.

(i). **local and mobile or cloud solutions:** Data management will be different in local, mobile, or cloud. Local or desktop and mobile data management are mainly handled by the owner and no other person has access to check, update or retrieve the data. Users can use User ID/password to protect data from unknown users. In the case of cloud environment, data management must be handled with proper standard and guideline, If data is not protected with ID/password or sensitive data is not sending using an encryption-decryption mechanism, data can be lost, or misused by another user. Nowadays many users store common data like resumes, the medical reports in a cloud server, so in the future, it will be easy to share(any job search or emergency medical support) with anyone from the cloud network. Still

many users not ready to use the cloud network because of security but if follow the data protection mechanism, data can be stored and retrieved from the cloud network.

(ii). ERP and EHR implementations: Enterprise Resource Planning(ERP) and Electronic Health Record (EHR) both require data management inefficient way with proper data protection. Both contain sensitive data like SSN numbers, bank account details, patient medical history, etc. ERP is used in all IT companies along with some other fields, like medical, library, etc. EHR is used to store the patient records in a cloud network, so in case of any emergency patient records can be accessed from anywhere and anytime that saves time, cost, and patient's life. It also reduces manual error; data duplicate issues and all data can be accessed from any device including mobile phones [4].

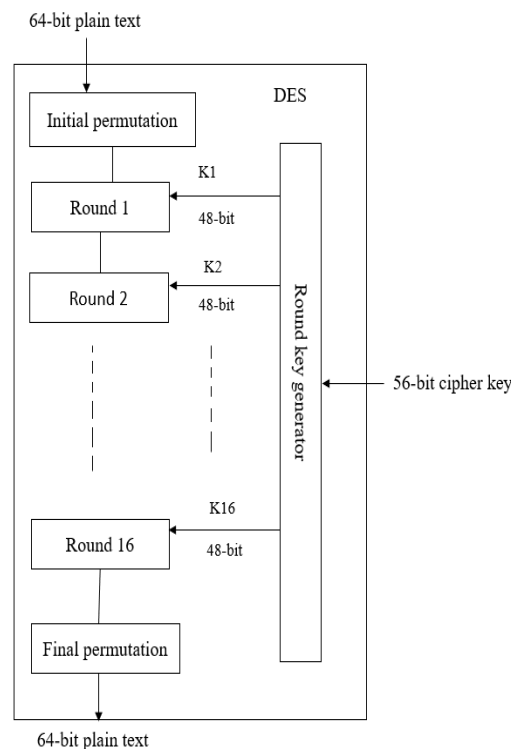
VII. THE STRUCTURE OF ALGORITHM AND PROGRAMMING LANGUAGE

There are multiple algorithms in all domains, two algorithms, one from cloud computing and the other from healthcare will be discussed in this article.

(i). DES and AES Algorithms in Cloud Security

Both algorithms are used to encrypt and decrypt data in cloud computing.

DES: The Data Encryption Standard (DES) is constructed by implementing a symmetric-key block cipher. The size of the block is 64 bit and has a 16 round Feistel structure [5]



Working of DES

Fig.1. The structure of Data Encryption Standard (DES)

AES: The Advanced Encryption Standard (AES) is replaced because of the slow speed and the small key size of DES [5].

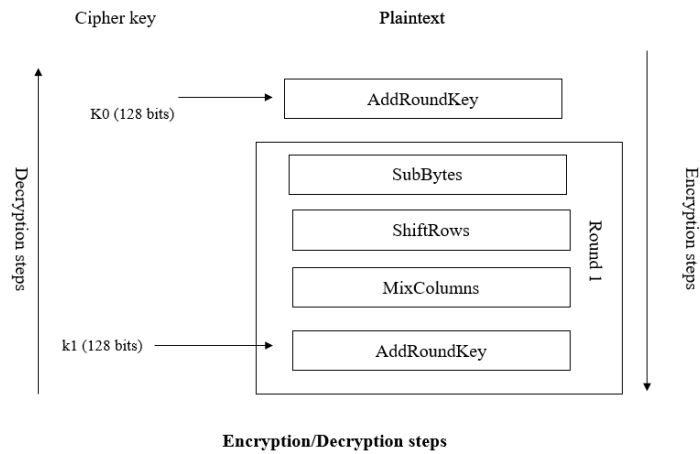


Fig.2. The structure of Advanced Encryption Standard (AES)

(ii). **Support Vector Machines (SVM):** SVM is the most popular machine learning algorithm in the healthcare industry. It is used for the detection of outlines, regression, classification, image segregation, protein classification, text categorization and to predict the medication observance of heart patients. This helps to save many lives by avoiding serious consequences, hospital readmission, etc. For the given dataset, need to classify green, square, and orange circles. The goal is to create a distinction between green squares and orange circles by creating a line with two classes. (diagram a). Let us visualize some of the lines- red and blue line, The red line cannot be the ideal line as it is too close to the green class (diagram b). According to SVM, let's find the points (support vectors) that lie closest to both classes. A margin has defined the distance between the points and the dividing line. The hyperplane becomes the optimal one, When the margin reaches its maximum (diagram c) [6].

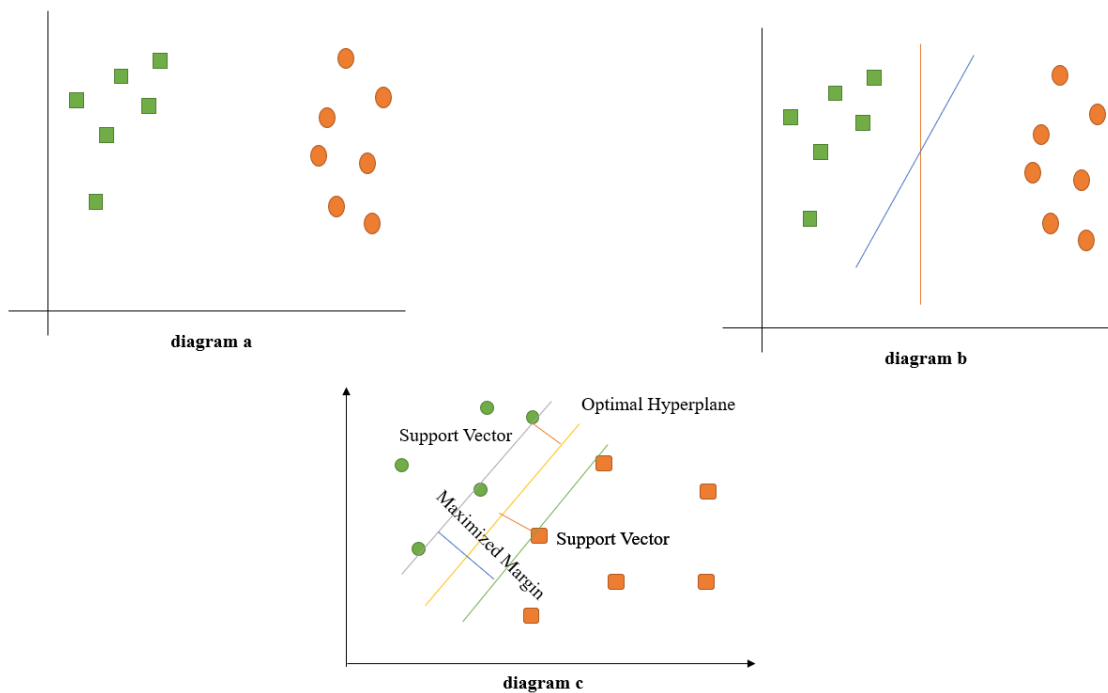


Fig.3. Support Vector Machines (SVM)

VIII. FEW APPLIED EXAMPLES WITH SOLUTION

(a). In-house development: The in-house development application is internal to that organization developed by their programmer without any external help. For example, a vendor company that has a relation with the IT sector decides to build and launch its own digital products. They will ask their own software developer or in-house developers to develop the code and will conduct a hiring method to select candidates for project requirements. The in-house developer is allowed to maximize the project customization, which reduces bugs and supports the entire development cycle [7]. Also, to maintain proper code standard it's recommended to document all project-specific documentation and share with the team. They should use a common framework for large files, error handling, and resubmission in case of any failure.

(b). ERP solutions: Enterprise Resource Planning (ERP) is used to automate multiple activities inside and outside the organization. It supports Real-time operation, Support for all applications/components, On-premises, cloud-hosted, or SaaS deployment, common database. ERP has used almost all domains including Healthcare and Hospitality, Food and Beverage, Manufacturing, Industrial Machinery and Components, Construction and Home Improvement, Healthcare, Pharmaceutical, and Life Sciences, Agribusiness, Farming and Agriculture, Clothing, Consumer Goods and Retail, Electronics and Technology. It is important to choose the correct ERP system that meets all goals and supports implementing an ERP system in an organization. In ERP all data must be stored in an encrypted format and multi-factor authentication must be enabled to avoid any fraud issue [4].

(c). Packaged software implementations: Many companies like to purchase packaged software to use multiple features, for example, Microsoft offers multiple features like MS Office, Excel, PowerPoint, Cloud-Azure, Teams (meeting and chat). It is advisable to purchase all features with a license file rather than using the free version. Use of free version is not recommended because of virus attack, limitation of the software, and company code of conduct. Few details must be followed to ensure that the packaged software implementation project directs on business results [8].

(i). Conduct business training: It's good practice to take some training (internal or external) to understand the all feature before using the software.

(ii). Implementation Business-oriented documentation: Documentation is needed to support and understand the software, any user manual is required for all versions to understand the software, what changes are there in the upgrader version before start working on this [8].

(d). Mobile applications and mobile websites (MAMW): MAMW is used to build and support applications in mobile. It is recommended to follow key steps and precautions when developing MAMW. We install many mobile applications nowadays, it's good practice to read all review comments and take a decision which application is best and user friendly before installation.

Key Steps for Implementing MAMW

(i). Programming for MAMW: A data can process a web application server running on Cold Fusion via mobile devices or web browser. MAMW users are allowed to access library websites search engines using smartphones.

(ii). Testing MAMW: This is mandatory to test with real data. Content. Display/design and Functionality must be tested before launch in production. the User-Agent Switcher Add-On for Firefox can be used to test a mobile website. web-based services like Device Anywhere and Browser Cam can be used to test the functionality of MAMW.

(iii). Training Patrons: training patrons is required to understand newly developed MAMW. Mobile search, explore the mobile literacy skills and how to use new systems can be managed by user training.

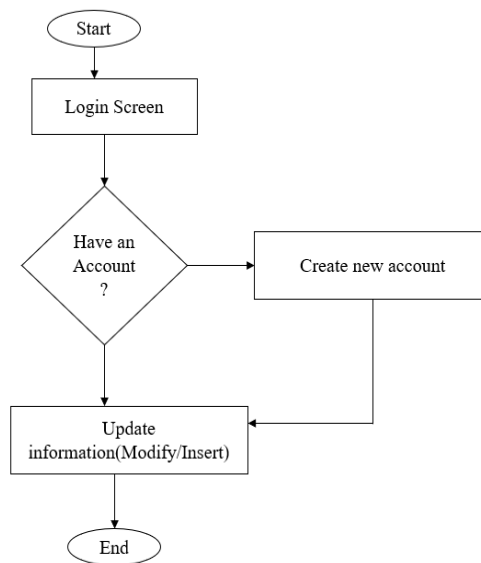
(iv). Documentation and Version Control of Software: To develop MAMW, the use of Open-source software is increasing. It is important to implement version-control software (for example GitHub or subversion) to upgrade and distributed across the world. a code repository with a centralized database is provided by Version control software to share the code to avoid overwriting or reverting code changes. Minimize errors and maximize coordination effort [9]



IX. CREATE CORPORATE STANDARDS - A DATABASE AND APPLICATION DESIGN AND DEVELOPMENT

This article will explain the details about when a user register in any site first time, what happens in backend started from the algorithm, store data in the database, coding structure and search record from the database.

(a). Algorithm



Steps :user registration

Fig.4. Step details: User Registration

(b). Database: The database can be selected based on some criteria, for example, if the company using Microsoft azure cloud, they prefer to use Redis or SQL database. It's also important only database administration (DBA) has database admin access to protect data from unauthorized users.

(c). Coding Structure

Print Employee Records in Python Code


```

import sqlite3
from sqlite3 import Error
def sql_connection():
    try:
        conn = sqlite3.connect('mydatabase.db')           # select database
        return conn
    except Error:
        print(Error)                                     # Print Error
def sql_table(conn):
    cursorObj = conn.cursor()
    cursorObj.execute("CREATE TABLE salesman(salesman_id n(5), name char(30), city
char(35), position char(40));")                          # create the table
    cursorObj.executescript("""
INSERT INTO salesman VALUES(1,'Tom', 'USA', 'Developer'); # Insert Employee records
INSERT INTO salesman VALUES(2,'Nik', 'UK', 'Tester');
INSERT INTO salesman VALUES(3,'Paul', 'London', 'Team Lead');
INSERT INTO salesman VALUES(4,'Julle', 'Paris', 'Project Manager');
""")
    conn.commit()
    cursorObj.execute("SELECT * FROM salesman")
    rows = cursorObj.fetchall()
    print("Employee details:")                            # Print details
    for row in rows:
        print(row)
sqlite_conn = sql_connection()
sql_table(sqlite_conn)
if (sqlite_conn):
    sqlite_conn.close()
print("\nThe SQLite connection is closed.")

```

Output:

Employee details:

(1, 'Tom', 'USA', 'Developer')

(2, 'Nik', 'UK', 'Tester')

(3, 'Paul', 'London', 'Team Lead')

(4, 'Julle', 'Paris', 'Project Manager')

The SQLite connection is closed.

(d). Search or update record from database: Programmers can search or update any record from the database using commands (select, update, delete, etc) or they can write code and perform all database operations. Each record has a unique or primary key (for example Employee ID, Student registration ID, etc), This key helps for any duplicate submission and search any record from the database. Database backup is also required monthly or quarterly basis. It is important to run the correct query to avoid any data loss and delete operation should be performed carefully by authorizing user.

X. CONCLUSION

The First step to write any program is to analyze and select the correct algorithm. The second step is to select a database depends on data (large, real, or batch, etc). The third step is to follow coding guidelines, standards and write documentation on technical design. The fourth step finalizes the programming language depends on company policy, environment, and domain. The fifth step is code implementation with comments and follows variable names and other factors and user testing with test and real-time data. The next step is to get code and testing signoff from the business and ready for production deployment. Many times, there is a production issue because of a lack of testing with real data. So, it's important to test with real data for few test cases. Also, sometimes few real-time scenarios and solutions missing during analyzing time, it's important to capture each scenario during the algorithm and analyze time. A bug-free and user-friendly code implementation can be possible using coding guidelines and standards.

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BIOGRAPHY

Nabanita Das is a Senior Software Engineer and Integration Consultant. She has over 16 years of work experience with Middleware webMethods, Cloud Microsoft Azure & AWS, and domain- Healthcare, Banking, Insurance, Retail, Rx, HR, Finance, and Cyber security. She has in-depth knowledge of Integration, APIs, Security, Governance, and API standards. She is responsible for designing and developing integration solutions to support API and batch file transfer between various internal/external applications & partners. She has successfully delivered several complex projects with high accuracy & efficiency, resulting in significant cost savings & improved business processes with an exceptional team player, possessing outstanding technical & analytical skills, commitment, a positive attitude, selfless assistance, and excellent contributor. Her active participation in analysis and brainstorming solutions to fix defects and build them without compromising quality is commendable. She has excellent interpersonal skills and has consistently built strong relationships with stakeholders and clients. She persistently shares her views of project risks and provides solutions to address issues with conflicting priorities in high-pressure situations. She holds a Bachelor's degree in Computer Science & Engineering and an MBA in Project Management. Currently pursuing a Ph.D. in Computer Science from the National University. Her research interests are AI, Cyber Security, Integration, and Cloud computing.



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