**CHAPTER – 1**

**INTRODUCTION**

**1.1Abstract**

In this project, we're going to use a special kind of computer guessing game called "linear regression" to help us understand our house's electricity monster. Linear regression is like a super-smart rule that helps us guess how much electricity our house will eat based on other things, like the weather or the time of day. We want to use this rule to make our houses more energy-efficient and help our planet.

Now, let's talk about how this "linear regression" game works. Imagine you have a graph, like a picture with lines and dots. On one side of the graph, you have how much electricity your house ate, and on the other side, you have things like the temperature outside or the time of day. Linear regression helps us draw a straight line through the dots on the graph, so the line is as close as possible to all the dots.

This line is like a special rule that helps us guess how much electricity our house will eat. For example, if we see that the dots go up when the temperature goes up, the line will also go up. This means that when it's hotter, our house eats more electricity. Linear regression helps us find the best line that fits all the dots, so our guesses are as accurate as possible.

We can use this line to make predictions. If we know the temperature outside, we can look at the line and guess how much electricity our house will eat. It's like using a ruler to measure how tall you'll be as you grow. Linear regression helps us find the best ruler for electricity.

**1.2Characteristics**

**Data Collection and Preparation**

The project involves collecting a wide range of data related to household electricity consumption. This goes beyond just total usage and includes specific measurements like electricity used by different parts of the house (e.g., sub-metering).It also incorporates external factors that influence energy consumption, such as weather data (temperature, humidity), time-stamped information (time of day, day of the week, month of the year), and potentially even occupancy data (when people are home).Think of this as not just noting down how much the "electricity monster" ate, but also what it ate (different types of electricity), the weather outside, what time it ate, and who was around.

**Robust Data Preprocessing:**

The project includes careful handling of missing data, which might involve filling gaps using appropriate techniques (e.g., replacing missing values with the average or median).It also involves identifying and addressing outliers, which are unusual data points that could skew the analysis.Data may also need to be transformed or scaled to ensure it's in a suitable format for the linear regression model.

**Feature Engineering**

The project might create new variables or features from the existing data to improve the model's accuracy. For example, it could calculate hourly or daily averages of electricity consumption, create a "time of day" category (morning, afternoon, evening, night), or derive a "weekend/weekday" indicator. This is like creating new clues for our electricity detective by combining existing information.

**1.4 Applications**

Then are some operations of a design concentrated on prognosticating and assaying ménage power consumption using a machine learning algorithm( direct retrogression), explained in simple terms.

**Smart Homes and robotization**

The prognostications from the design can be used to automate energy- saving conduct in smart homes. For illustration, the system could automatically acclimate thermostats, turn off lights, or schedule appliance operation to minimize energy consumption when it predicts high operation or when electricity prices are high.

**Energy Monitoring and Management Systems**

The design can be integrated into energy monitoring systems that give homeowners with detailed perceptivity into their energy operation. These systems can display real- time energy consumption, identify energy-empty appliances, and give individualized recommendations for reducing energy waste.

**Demand Response Programs**

Utility companies can use the design's prognostications to more manage electricity demand on the grid. They can apply demand response programs that incentivize homeowners to reduce their electricity consumption during peak demand ages, helping to help knockouts and stabilize the grid.

**Appliance Efficiency Analysis**

The design can be used to dissect the energy consumption patterns of different appliances. This information can help consumers make informed opinions about copping energy-effective appliances and can also help manufacturers design more effective products. .

##### **1.5 Significance**

**Energy effectiveness and Conservation**

The design helps homes understand their energy consumption patterns, identify areas of waste, and make informed opinions to reduce energy operation. This leads to energy conservation, which is pivotal for environmental sustainability and reducing the carbon footmark.

**Cost Savings**

By prognosticating energy consumption and relating energy- saving openings, the design enables homes to lower their electricity bills. This can affect in significant cost savings over time.

**Grid Stability and Reliability**

The design's prognostications can help mileage companies more manage electricity demand on the grid, especially during peak ages. This can help knockouts and insure a more stable and dependable electricity force. .

##### **1.6 Advantages**

**Saves You Money:**

* It's like a smart tool that tells you when you use the most electricity. Electricity can cost more during certain times of the day (like when everyone is using their AC).This tool helps you use less electricity during those expensive times, so you pay less.

**Helps You Use Less Energy:**

* It can show you which things in your house use the most electricity.Then you know what to change. Maybe you can use some things less, or get new things that use less power.

**Choose the Best Appliances:**

* When you buy new stuff for your house, this tool can help you pick the ones that won't use too much electricity.

**Good for Our Earth:**

* Electricity plants can make dirty air.If we use less electricity, they don't need to make as much, so the air stays cleaner.

**Improving Power Grids:**

* This tool helps the people who make electricity.They can know when lots of people will need electricity, so they can make enough and we don't have blackouts (when the power goes out).

**1.7 Summary**

This project is like creating a smart helper that learns how your house uses electricity.First, we gather information, like keeping a diary of everything the "electricity monster" eats each day. This includes how much electricity is used and things that change electricity use, like the weather or time of day. We clean up this information to remove mistakes and organize it so the computer can understand. Then, we use a special computer program called linear regression to find patterns in the data. Linear regression is like drawing a line on a graph to see how electricity use changes with things like temperature. The computer learns from this data to predict how much electricity the house will use in the future.   .

##### **2.2 Related Work:**

##### **Literature Survey: Review of Prior Work on Household Energy Prediction**

**1. Motivation and Background**:The importance of analyzing household electricity consumption is widely recognized. Accurate prediction plays a vital role in energy conservation, cost optimization, and promoting sustainable practices.

* Researchers have explored various methodologies to forecast household energy usage, aiming to develop effective prediction models.
* This pursuit is analogous to predicting consumption patterns in other domains, such as estimating daily household food consumption to optimize resource allocation

**2. Methodological Approaches**

* **Statistical Modeling:** Traditional approaches often employ statistical methods, with linear regression being a prominent technique. Linear regression models establish a linear relationship between energy consumption and influencing factors like temperature.
* **Machine Learning Techniques:** More recent studies have leveraged the capabilities of machine learning algorithms to enhance prediction accuracy. Machine learning models can learn complex patterns from historical data and improve their predictive performance over time.

**3. Key Findings and Project Context**

* **Comparative Analysis:** Research indicates that while statistical methods like linear regression can provide reasonably accurate predictions, machine learning algorithms often outperform them, especially in capturing non-linear relationships and complex dependencies in energy consumption data.
* **Data Quality and Relevance:** The accuracy of energy prediction models is highly dependent on the quality and relevance of the input data. High-resolution data and the inclusion of pertinent features are crucial for achieving reliable forecasts.

**2.3 Existing System**:

**Description:**

Many homes now use smart meters, which are digital electricity meters that automatically record and transmit electricity usage data to the utility company.This is an improvement over traditional meters that require manual reading.Often, smart meter data is made available to homeowners through online platforms or mobile applications.These platforms/apps provide users with access to their energy consumption data, often with visualizations and some basic analysis.

**2.3.1 Disadvantages**

* **Limited Information:** Simple electricity meters only provide total consumption, lacking details on where energy is being used within the household.
* **Cost and Complexity:** Home energy monitors, while informative, can be expensive to purchase and install, limiting their accessibility.
* **Data Limitations:** Even with smart meters, the available data might not always be granular enough to capture the nuances of appliance-level consumption or the impact of various factors.
* **Inaccuracy of Rules:** Rule-based systems are often simplistic and may not accurately reflect the complex and dynamic nature of energy consumption patterns.
* **Complexity of Analysis:** Statistical analysis requires expertise and may not effectively model non-linear relationships or capture all the variables influencing energy use.

##### **2.4 Problem Definition**

Currently, a significant challenge exists in effectively managing household energy consumption due to the unpredictable nature of electricity usage patterns. Homeowners often lack clear insights into how much electricity they will consume at any given time, making it difficult to optimize energy usage and minimize costs. This uncertainty also poses challenges for energy providers in balancing supply and demand, potentially leading to inefficiencies and grid instability.To address this problem, there is a need for a smart system that can accurately predict future household electricity consumption. Such a system would analyze historical electricity usage data, which essentially serves as a record of past energy consumption, and incorporate other relevant factors that influence energy use.

##### **2.5 Proposed System**

This proposed system would work by first keeping an eye on how much energy different appliances and devices in your home are using, and when they're being used. Think of it as collecting data on your household's energy habits – when do you usually switch on the lights, how long does the TV stay on, when do you typically use the washing machine, and so on.

Once it has enough of this information, the system can start to predict how much energy your household is likely to use in the near future – maybe in the next hour, the next day, or even the next week. It's like it's learning your routines and anticipating your energy needs.

But it doesn't stop there! This system can also analyze your energy consumption patterns. It can tell you things like which appliances are using the most energy, if there are any unusual spikes in usage, or even suggest ways you could potentially save energy based on your habits.

For example, it might notice that your air conditioner is running at full blast even when only one person is in the room, and suggest adjusting the temperature or using a fan instead. Or, it could identify that leaving devices plugged in even when they're turned off is adding to your energy bill.

**2.5.1 Advantages of Proposed System**

* **Saves You Money:** Our smart helper can tell you when you're likely to use a lot of electricity, which is often when it costs the most. This helps you avoid using too much electricity at those expensive times, so you can pay less on your electricity bill. It's like knowing when the candy is most expensive at the store so you can buy it at a cheaper time.
* **Helps You Use Less Energy:** Our system can show you which things in your house use the most electricity, like an energy-hungry monster. This helps you know where you can cut back. Maybe you'll learn that your old TV uses a lot of energy, and you can save energy by turning it off when you're not watching it or getting a newer one that uses less power.

### CHAPTER-3

#### SYSTEM DESIGN

**3.1 Modules**

Let's break down the essential corridor for prognosticating and assaying how important energy your ménage uses, all explained in a friendly, mortal way. suppose of these as the crucial constituents for a smart home energy operation system.

Then are the main modules involved

* Data Collection
* Data Preprocessing
* Prediction Module
* Analysis Module
* Feedback and Control

**1. Data Collection- Gathering the suggestions**

* Smart cadence Integration This is like having a detailed energy journal. The system needs to connect with your smart cadence to get real- time or near real- time data on your electricity consumption. It records how important energy you are using, and when.
* Appliance Monitoring( Optional but Helpful) For a more detailed picture, you might have smart entrapments or other bias that track the energy use of individual appliances. This helps pinpoint energy swillers.
* Environmental Data Just like we dress else depending on the rainfall, your energy use changes too. So, the system frequently pulls in data like temperature, moisture, and indeed sun situations from original rainfall stations or smart home detectors.
* residency Data( If Available) Knowing if someone is home and in which apartments can be a big factor. This could come from stir detectors, smart door cinches, or indeed learning patterns from your smart bias.
* stoner Input occasionally, the stylish information comes straight from you! You might input details about your ménage size, typical routines, or when you anticipate to have guests( which might increase energy use).

**2. Data Preprocessing- Cleaning and Organizing the Information**

* drawing Up the Data Raw data can be messy. This module identifies and handles effects like missing readings, crimes, or unusual harpoons in energy use that might not be accurate. It's like proofreading a document to fix miscalculations.
* Feature Engineering- Creating Useful perceptivity This is where the system gets a bit clever. It takes the raw data and creates new, more helpful pieces of information. For illustration, it might calculate the average energy use during specific times of the day, identify peak operation ages, or flag seasonal changes in consumption. suppose of it as pressing the most important corridor of the data.
* Data Normalization/ Scaling To make sure all the different types of data( like temperature and energy use) are on a analogous scale, this module adjusts the values. This helps the vaticination models work more effectively.

**3. Prediction Module- vaticinating Future Energy Needs**

* Model Selection This is the brain of the vaticination process. It uses algorithms( frequently from the world of machine literacy or statistics) to learn from the literal data and environmental factors. Different types of models live, like those that look for patterns over time( time series models), or those that consider colorful impacting factors( retrogression models, neural networks). The system chooses the stylish model( or a combination of models) for your specific situation.
* Model Training The chosen model" learns" by assaying the literal data. It identifies connections between different factors( like rainfall and time of day) and your energy consumption. This is like studying once examinations to prepare for a unborn bone.
* Energy soothsaying Once trained, the model uses the current and prognosticated environmental data( and potentially residency or stoner input) to read how important energy your ménage is likely to use in the near future( e.g., the coming hour, day, or week).

**4. Analysis Module- Understanding history and Present Energy Use**

* Pattern Recognition This module digs into your literal energy data to identify trends and patterns
* Anomaly Discovery It can also spot unusual energy operation patterns that might indicate a problem, like an appliance conking or energy being wasted. It's like a erected- in energy operative.
* Benchmarking This point allows you to compare your energy consumption to analogous homes or your own once operation. This can help you understand if you are using more or less energy than anticipated.
* Visualization and Reporting To make the information easy to understand, this module presents the data and analysis in visual formats like maps and graphs. It might also induce reports recapitulating your energy operation andimmolation perceptivity.

**3.2 Input and Output Design**

**INPUT DESIGN**

**Here's how we'd design the input, focusing on a human-friendly approach:**

**1. Household and User Profile:**

* "Tell us a bit about your home." (Instead of "Enter dwelling characteristics")
* "What type of home do you live in? (e.g., apartment, house, townhouse)"
* "How many people live in your household?"

**2. Appliance and Device Information:**

* "What kind of appliances do you have?" (Instead of "Appliance inventory")
* "Let's list your major appliances: Refrigerator**,** AC units, Heating system, Waterheater, etc."
* **"**For each appliance, do you know the model or energy rating?(If available)" (Helps estimate power consumption)

**3. Energy Consumption Data (If Available):**

* "Do you have access to your past energy bills? (If yes, you can upload them, or enter some information)"
* "We're interested in your monthly energy usage (kWh**)** if you have it handy."
* "If you have a smart meter, would you like to connect it?"

**4. Environmental Factors:**

* "What's your preferred temperature setting for heating and cooling?"
* "Are there any specific weather patterns in your area that significantly affect your energy use? (e.g., extreme heat, cold snaps)"
* The system can automatically pull weather data based on the users location.

**5. User Preferences and Goals:**

* "What are your goals for energy management?"
* "Are you primarily interested in saving money, reducing your environmental impact, or both?"
* "Are you interested in receiving tips on how to reduce your consumption?"
* "Would you like to setup alerts for unusually high energy consumption?"

**Key Design Principles:**

* **Conversational Tone:** Use natural language that feels like a friendly conversation.
* **Progressive Disclosure:** Don't overwhelm users with too many questions at once. Break it down into manageable sections.
* **Visual Aids:** Use icons, images, and progress bars to make the input process more engaging.

**OUTPUT DESIGN**

To provide homeowners with actionable insights into their energy consumption, helping them understand their patterns and make informed decisions about energy management

**1. Identifying Specific Output Needs:**.

* **Predictive Consumption Forecasts:**
  + Projected energy usage for the upcoming week or month.
  + "What-if" scenarios to explore the impact of changes (e.g., upgrading appliances, adjusting thermostat settings).
  + Projection of future cost based on current consumption and predicted consumption.

**2. Methods for Presenting Information:**

* **Interactive Dashboards:**
  + Clear and concise charts and graphs (e.g., line charts, bar charts, pie charts).
  + Interactive elements to allow users to drill down into specific data points.
  + Color-coded indicators to highlight key information.

**3. Output Formats:**

* **Web-based Dashboard:**
  + Accessible from any device with an internet connection.
  + Real-time data updates.
  + Customizable views and settings.
* **Mobile App:**
  + User-friendly interface for on-the-go access.
  + Push notifications and alerts.
  + Simplified data visualizations.

**3.3 Introduction To UML**

UML stands for Unified Modelling Language which is used in object-oriented software engineering. Although typically used in software engineering it is a rich language that can be used to model an application structure, behaviour and even business processes. Which is designed to provide a standard way to visualize the design of a system.

**Class Diagram**

Class diagrams are most used UML diagram type. It is the main buildingblock.1 of any object- oriented solution. It displays the System’s classes, their attributes and functions as well as relationship between them. Most modelling tools divide a class has three parts, the name at the top, attributes in the middle and operations or methods at the bottom.

**Component Diagram**

A component diagram depicts the structural relationships between components of a software system. These are mostly used when working with complex systems that has many components. Components communicate with each other using interfaces. The interfaces are linked using connectors.

**Use Case Diagram**

Most known diagram type of the behavioural UML diagrams, use case diagrams gives a graphic overview of the actors involved in a system, different functions needed by those actors and how these different functions are interacted. t’s a great starting point for any project discussion because you can easily identify the main actors involved and the main processes of the system.

**Sequence Diagram**

In UML, sequence diagrams depict how items interact with one another and in what order. It's vital to notice that it displays the interactions for a certain scenario. The processes are displayed vertically, with interactions depicted as arrows.

**CHAPTER-4**

**SOFTWARE REQUIREMENT SPECIFICATION**

**4.1 Demand Specification**

* Begin with Empathy instead of simply fixating on figures, we have to have an idea as to why individuals watch around energy consumption. Are they outraged by bills? The terrain? Comfort?
* substantiated lives Consider the system inquiring, "Describe your house. How many people live in it? What household appliances do you use on a regular basis? What's your daily routine?" This enables substantiated predictions.

**2. Building a stoner-Friendly Interface**

* Straightforward and Simple Avoid jargon. Use plain, conversational language.
* Interactive Visualizations Enable addicts to investigate their data. For example
* Have them click on a shaft in energy usage to find out which appliance caused it.
* provide "what-if" scenarios" If you replaced your bulb with LED lights, you can save X quantum."

**3. vaticination and Analysis:**

* answerable predictions Don't simply provide a number. Tell us why the system is predicting a specific position of consumption.
* \*" rested on literal facts and decline predictions, we expect your energy operation to rise next week as a result of warmer weather."

**4. Feedback and replication**

* Collect stoner Feedback Ask addicts regularly for their research on the system.
* Iterative Design Improve the system continually based on stoner feedback and fresh information.
* limpidity Be transparent about how the system functions and how it utilizes data.

**4.3 Operating Systems supported**

* Windows

**4.4 Technologies and Languages used to Develop**

* Python

**4.5 Hardware Requirements**

* System : Pentium IV 2.4 GHz.
* Hard Disk : 40 GB
* Floppy Drive : 1.44 Mb.
* Monitor : 14’ Colour Monitor.
* Mouse : Optical Mouse.
* Ram : 512 Mb.

**4.6Software Requirements**

* Operating system : Windows 7 Ultimate.
* Coding Language : Python.

**4.7 System Study**

**Smart Home Energy Management**

Picture yourself in a house that knows you and your energy habits like you do. Our mission also's to create a system that serves as a beneficial energy adjunct. We want to empower homeowners to not only save on their electricity bills, but also help make the planet greener. By providing clear perceptivity and allowing you to have control over how your home consumes energy, we hope to make energy effectiveness easy and achievable. It's about making your home smarter, so you can live more sustainably.

**Data Input**

In order to provide wise opinions, the system must see what is going by.think of it as collecting ideas.First, we must understand how significant electricity you are consuming in real-time and cumulatively, such as a comprehensive energy diary from intelligent meters.However, that is truly better, If we are able to perceive which devices are consuming the most power via intelligent entrapments or sensors. also, we consider the collapse – temperature, humidity, and sunlight – because that affects toast and cooling.

**Processing:**

Now, all that information must be reused.First, we apply machine knowledge, such as training a computer to celebrate patterns.This allows us to forecast unborn energy consumption rested on previously trends, downfall prophecies, time of day, and your routines.also, we analyze the information to see where the energy is headed. We search for association with other predictors, identify unplanned- sighted harpoons that could sign a problem.

**Output (User Interaction):**

The system's job isn't complete until it gives you useful feedback. We want to show you your energy use in easy-to-understand charts and graphs. We'll send alerts if something seems off, like an appliance running too long, or suggest adjustments based on the weather. We'll also give you personalized tips, like shifting energy-intensive tasks to off-peak hours or adjusting your thermostat for maximum savings. If you want, the system can even automate some actions, like turning off lights or scheduling appliances, to optimize energy use for you.

**User Experience (Human Touch):**

Ultimately, this system is for people, so it needs to be easy to use. We're aiming for a simple, intuitive interface that anyone can understand. The recommendations should feel personal and relevant to your lifestyle. We'll always explain why we're making certain suggestions, so you're not left in the dark. And most importantly, you're always in control. You can override any automated actions or adjust settings to fit your needs. It's about empowering you, not taking over

**CHAPTER -5**

**SYSTEM IMPLEMENTATION**

System implementation is the process of defining how the information system should be built (i.e., physical system design), ensuring that the information system is operational and used, ensuring that the information system meets quality standard (i.e., quality assurance).

**PYTHON**

Python is a general-purpose interpreted, interactive, object-oriented, and high-level programming language. An interpreted language, Python has a design philosophy that emphasizes code readability (notably using whitespace indentation to delimit code blocks rather than curly brackets or keywords), and a syntax that allows programmers to express concepts in fewer lines of code than might be used in languages such as C++or Java.

**Overview of Tools Used for Project**

**5.1.2 Features of Python**

Python is a widely used programming language that is known for its readability and versatility. Here's the overview of its major features in a human-readable manner:

**Easy to Learn and Read**:

Python's syntax is straightforward and minimal, almost a read of simple English. It makes it easy to learn and easy to use, cutting the time it takes to learn and code.

**Flexible and Extensively Applied:**

Python has the ability to be applied for any number of tasks, ranging from web and data science applications to artificial intelligence and scripting. It is such a versatile tool that it can accomplish nearly anything.

**Large and Active Community:**

Python boasts a vast community of developers who help develop it and assist users. This implies that you can readily find assistance and resources online.

**Extensive Standard Library:**

Python has an extensive standard library of built-in modules and functions that offer ready-to-use solutions for most programming tasks. It's as if you have a toolbox with handy tools.

**Cross-Platform Compatibility:**

Python is capable of executing on multiple operating systems, such as Windows, macOS, and Linux. This enables you to code once and execute anywhere.

**5.1.3 Advantages**

The following advantages and benefits make Python suitable for developing applications.

* Easy learning and rapid development are enabled by readability and simplicity.
* Flexibility enables Python to be used in different fields, ranging from web development to data science.
* Comprehensive support from the community offers ample resources, documentation, and support.

**5.1.4 Packages used in python**

**TensorFlow**

Google designed the TensorFlow open- source machine literacy system, which makes it easy to develop all kinds of machine literacy and deep literacy models and train and apply them. Since it has an effective, flexible, and scalable armature, it can be run in product or exploration surroundings. Tensors aremulti-dimensional arrays used in the representation of data and are also the core element of TensorFlow.

**Scikit-learn**

Scikit- learn is an open- source machine literacy library for Python. Scikit- learn provides a range of tools and algorithms for applying machine literacy to a variety of tasks similar as bracket, retrogression, clustering, and dimensionality reduction. Scikit- learn is erected on top of other Python libraries similar as NumPy, SciPy, and Matplotlib, and it interacts relatively well with other data wisdom tools in the Python ecosystem.

**NumPy**

NumPy Numerical Python or NumPy is a high- position Python library for numerical computing.Large,multi-dimensional arrays and matrices are supported, as are a number of fine operations that can be used to efficiently manipulate these arrays.A paragraph summary of NumPy follows. NumPy is the base of numerical and scientific computing in Python.It provides a dynamic array object through which inventors are suitable to carry out complex fine operations with ease. The central piece of it's the ndarray, or N- dimensional array, which offers a general data structure for homogeneous data type array representation. The arrays offer a high- performance relief for the native data types and may be initialized from Python lists, tuples, or other iterable types..

**Pandas**

They're famed for their white and black achromatism, plus their lovable faces. Pandas are also vastly risked, as there are smaller than 2,500 wild individualities. numerous reasons why the panda is liked by humans from each over the world is the fact that the panda is cute and sportful in nature. People love watching the panda roll about, play around, and enjoy the sunbathing, among other conditioning, and the Panda's sportful deeds have won so numerous hearts around the globe.

. **Matplotlib**

Matplotlib Matplotlib is a popular data visualization library in Python that allows druggies to produce a wide range of high- quality graphs, maps, and other visualizations. It was first released in 2003 and has since come one of the most extensively used libraries for data visualization in Python..

**Seaborn**

Seaborn is a important Python data visualization library. Its end is to deliver seductive and instructional statistical plates. With its high- position interface for generating enough plots with minimum coding, Seaborn makes it easy to induce complex visualizations.

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**CHAPTER-6**

SYSTEM TESTING

**SYSTEM TEST**

System testing is like taking in that robot to have a big, ultimate tuning up. We need to insure not only that one little element workshop, similar to its flashing lights or swinging arm. No, we are just hoping that each piece will snare together in perfect harmony. We want to insure the robot walks, addresses, blinks, and balls contemporaneously without causing us any trouble. Just as we had want our robot to serve faultlessly, we had want our computer programs to serve faultlessly as well! **Types of System Testing :**

Just as there are a number of ways of playing with our robot, there are a number of ways of testing it. Below are some of the most important bones.

**Unit Testing:**

let us say you are constructing your robot, and you want to test each small individual element so that they work separately before incorporating them. That is analogous to unit testing. You would check the robot arm to ensure it can move, the robot leg to ensure that it bends, and the robot voice to ensure that it speaks. In the programming of computers, we execute every little member of law collectively to insure they are performing duly previous to combining them together...

**Integration Testing :**

once you have collectively tested all the little pieces, you need to combine them all together and check whether they serve well as a collaborative. It is sort of like integration testing. You had check if the robot can walk and speak concurrently, or if its lights blink when it dances. In computer programs, we check how pieces of law interact with one another. We do not want them to quarrel, we want them to be friendly and communicate with each other!

**Functional Testing :**

This is original to testing whether your robot is able to perform all the effects it was designed to do. Is it suitable to move forward and backward? Does it tell the jokes in the right way? Is it suitable to gesture its arms? We are icing the robot does precisely what it is designed to do. In computer software, we test whether all the functionality works as intended..

**6.2 Test strategy and approach**

Field testing will be performed manually and functional tests will be written in detail.

**Test pretensions**

* altitudinous field entries should serve rightly.
* getElementsByName must be actuated from the discovered link.
* The entry screen, dispatches and responses should noway be braked down.

**effects to be tested**

* Determine if the entries are in the right format
* No repeated entries should be accepted
* All links should lead to the right runner.

Software integration testing is the incremental integration testing of two or further intertwined software factors on a single platform to produce failures caused by interface defects.The task of the integration test is to check that factors or software operations, e.g. factors in a software system or – one step up – software operations at the company position – interact without error.

**Test Results**: All the below test cases passed successfully. No blights set up.

**Acceptance Testing**

stoner Acceptance Testing is a veritably important stage of any design and involves high involvement by the end stoner. It also checks that the system is in compliance with the functional conditions.

.**Test Results:** All the test cases mentioned above passed successfully. No defects encountered.