

Municipal Corporation Complaint Detection App of Using Machine Learning

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ABSTRACT

Municipal Corporation deals with different day-to-day activities related to general public amenities. The application is designed to automate these activities and enable people to access the information. The main aim of the project is reducing the bulk amount of paper work and time too.

There may be chances to miss paper in existing system. But this electronically system is more efficient and secured. The public user register them self and easily send a petition to the municipal corporation about metro water connection, sanitation works, electricity maintenance, education systems. And you can easily register the birth and death certificates.

You can check your complaints status in online. And pay your taxes in online. Municipal Corporation officers and employees can view all the complaints from different users on different problems. Officer can maintain solved problems list and pending problems list.

The admin only have the power to change the all data's from the users and employees. Admin only have the details about all employees in the municipal corporation. The research methodology adopted for this study is Waterfall Methodology. In the system design, the data flow was modelled to capture the procedures used in the system. The tools used for the development are PHP programming language, JavaScript, Hyper Text Markup Language (HTML), Cascading Style Sheet (CSS), and MySQL. The MySQL server application served as the Database Management System (DBMS), while Visual Studio Code application served as the Integrated Development Environment (IDE). The ultimate achievement of this research is a web-based student complaint

management software that is very effective and efficient in meeting the project objectives and the same time, user friendly.

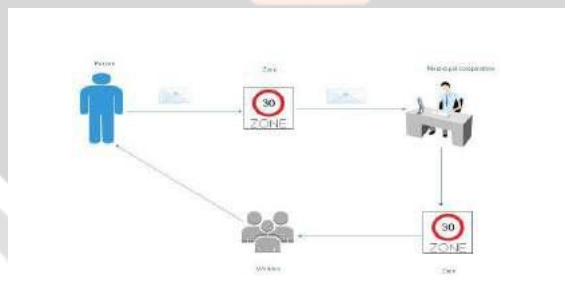


Keyword: -

Machine Learning, Data Preprocessing, Model Selection, Data Collection, Data Mining ,Clustering, Data Separation , K-means Algorithm, Modelbased Clustering.

1.Introduction

Before introducing our idea we want to say about the current situation in municipal corporation when people will complaints related to any problem like water problem then there is no reaction of government. It means that when a person write a complaint letter and then it will go to municipal office then give the report to the government employee then the employee check the complaint then it send that complaint letter to particular department after sending that department check the letter and it will take action on it so it is so long process . Due to which the problems of society not completed in particular time on in given time so that the society face many problems the working process of our government is to slow due to that the problems are increased and that problems are not completed Due to the manual procedure the head of municipal corporation does not have any proof to take action on the departments so that are the various problems of current working procedure in municipal corporation Now I would like to explain our project idea ,we want to create a website for complaint system where a user or people can write a letter and send it to the municipal office due to which the user time is save and at Admin side the government employee will check the website it will check the complaints and send the complaint to that particular when the complaint letter send to department the timer is started from that second then if the complaint is completed before 7 days then it will displayed into in green color if the problem is not solved it is converted into red color.

2.Literature Review:

In this literature review users gets all information about their complaint which they were registered in this “Modern municipal corporation”. smart follow is maintained using 4 panels. Which are explained as below

- User: This is first panel in this app once user .user can register their complaints using brief description and also capturing that specific images and uploading it in that complaint registration form in this form user can fill all their residential information
1. Municipal officer: This is second panel once user registered their complaint municipal officer simply login and see what is complaint and then he sends it to particular zone officer
 2. Zone officer: see that complaint which was sent through municipal officer and send it to particular zone workers then workers will do work and after that zone officer send msg to municipal officer that work done.

3. Super municipal officer: This is the last panel of this app this panel simply observe that all panel doing

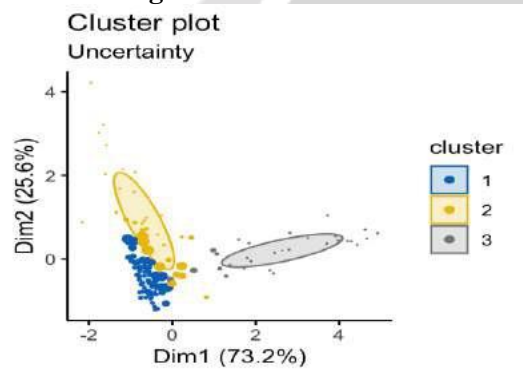


work proper or not.

4. Future Scope:

1. Feedback Mechanisms: Implementing feedback mechanisms within the app together input from citizens about the resolution process and service quality. This feedback loop can aid in continuous improvement and service optimization.
2. Scalability and Adaptability: Designing the app architecture to be scalable and adaptable to cater to the increasing volume of complaints and personal information.
3. Real-Time Monitoring: Developing real-time monitoring capabilities to track and reported This involves creating systems that can process and classify complaints promptly, leading to faster response times and improved civic services.

a. Clustering :



Model-based clustering is a statistical method used to group data into clusters based on underlying models. Instead of just assigning data points to clusters based on distances or similarities, model-based clustering builds a probabilistic model for each cluster. These models describe how the data in each cluster are generated, taking into account things like the distribution of the data and the relationships between different variables. By fitting these models to the data, model-based clustering can identify clusters in a more sophisticated way, often uncovering complex patterns and structures that other methods might miss

b. Machine Learning Approaches:

Machine learning is one of the latest technology in the IT world. Machine learning (ML) is defined as a discipline of artificial intelligence (AI) that provides machines the ability to automatically learn from data and past experiences to identify patterns and make predictions with minimal human intervention.

Machines learning can offer significant benefits to municipal corporations by leveraging data to improve decision-making, optimize processes, and enhance service delivery to citizens. Here's how machine learning can be applied

4.K-Means :

K-means is one of the oldest and most widely used clustering techniques. The name K-means comes from how each of the K clusters is represented by the mean of the points within that cluster. This point is called the centroid. The basic K-means algorithm is very simple and straight forward. Figure 9 describes this algorithm (Tan, Steinbach, and Kumar, 2006).

Basic K-means algorithm

The first step is to pick K initial centroids. K is the number of clusters wanted and is a user specified parameter. Next each data instance or point is assigned to the centroid it is closest to. This collection of points is a cluster. The centroid of each of these clusters is updated based on the points assigned to the cluster. These steps are repeated until there is no change in the centroids.

Instances are assigned to a centroid based on a proximity measure that quantifies closeness for a particular data set. There are several types of proximity measures such as Euclidean distance and Cosine similarity (Berkhin, 2002).

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2.1.2.2.2 EXPECTATION MAXIMIZATION (EM)

The EM technique is very similar to the k-means approach. They are both iterative in nature and start with a random guess. The difference lies in the idea of hard versus soft cluster membership. In k-means a hard membership approach is adopted. This means that an instance belongs to one and only one cluster. In EM a soft membership approach is used, which means that membership of an instance can be spread amongst many clusters.

The EM algorithm is a two step process: Expectation and Maximization. The expectation portion is the first step and involves calculating cluster probabilities (the expected class values). The maximization step involves calculating the distribution parameters. This step is the maximization of the possibilities of the distribution given the data. These steps are repeated until a “log-likelihood convergence is achieved.” (Berkhin, 2002 ,Witten & Frank 2005).

This part briefly describes the K-Means algorithm. K-Means algorithm is a typical clustering algorithm in data mining and which is widely used for clustering the large set of datas. In 1967, Macqueen was firstly proposed the K-Means algorithm, it was one of the most simple, non-supervised learning algorithms, which was applied to solve the problem.

This method is used to classify given data objects into K different clusters through the iterative, converging to a local minimum. So the results of created clusters are compact and independent.

The algorithm consists of two separate phases. In first phase, selects K -centers randomly, where the value K is fixed in advance. The next phase is to take each data object to the nearest center. Euclidean distance is generally considered to determine the distance between each data objects and the cluster centers when all the data objects are included in some clustes. The first step is completed and an early grouping is done. Recalculating the average of the early formed clusters.

This iterative process continues repeatedly until the criterion function becomes the minimum. Supposing that the target object is X , X_i indicates the average of cluster C_i , criterion function is defined as follows.

5.K-Means :

$$E = \sum_{i=1} \sum_{x \in c_i} |x - x_t|^2$$

E is the sum of the squared error of all objects in database. The distance of criterion function is Euclidean distance which is used for determining the nearest distance between each data objects and cluster center. The Euclidean distance between one vector $X=(X_1, X_2 \dots X_n)$ and another vector $Y=(Y_1, Y_2 \dots Y_n)$. The Euclidean distance $d(X_i, Y_i)$ can be obtained as follow:

$$d(x_i, y_i) = [\sum_{i=1} (x_i - y_i)^2]^{1/2}$$

The process of K-Means algorithm as follows:

INPUT: Number of desired clusters K and a database $D = \{d_1, d_2 \dots d_n\}$ Containing n data objects.

OUTPUT: A set of K clusters.

STEPS:

- 1) Randomly select K data objects from dataset D as initial cluster centers.
- 2) Repeat;
- 3) Calculate the distance between each data object $d_i (1 \leq i \leq n)$ and all K cluster centers $c_j (1 \leq j \leq k)$ and assign data object d_i to the nearest cluster.
- 4) For each cluster $j (1 \leq j \leq k)$, recalculate the cluster center.
- 5) Until no changing in the center of clusters.

The K-Means clustering algorithm always converges to local minimum. Before the K-Means algorithm converges, calculation of distance and cluster centers are done whereas the loops are executed a additional range of times, where the positive integer t is known as the number of K-Means iterations. The precise value of t varies looking on the initial starting cluster centers. The distribution of data points encompasses a relationship with the new clustering center.

So the computational time complexity of the K-Means algorithm is $O(nkt)$. N is the number of all data objects, k is the rang

6.Proposed Methodology

After careful analysis the system has been identified to have the following modules:

- 1) ADMIN MODULE
- 2) ZONE MODULE
- 3) USER MODULE (citizen)
- 4) SUPER MODULE

1)ADMIN MODULE:

This module provides administrator related functionalities. Administrator can create a new

account either for municipal officers or operators. By using this login id both Municipal officers and operators will log on to this portal and do all transactions which are assigned to them

2)ZONE MODULE:

This module is about an operator of Municipal Corporation. By using this module operators of Municipal Corporation can view all the complaints from different users on different problems. Operator can maintain solved problems list and pending problems list.

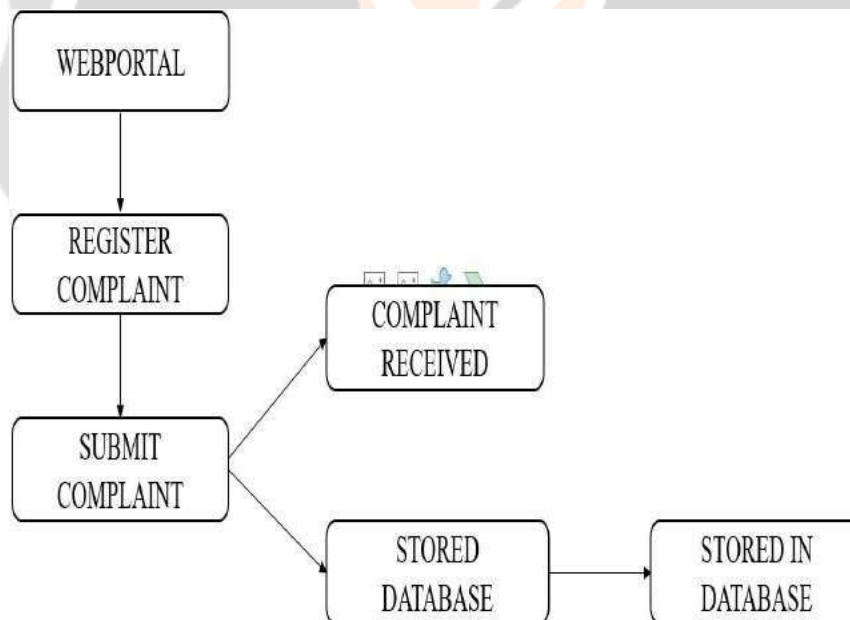
3)USER MODULE(citizen):

This module is about users of this portal. By using this module user can lodge any complaint to either operators or to municipal officer about problems such as water problem, electricity problem and sewerage problem. User must be registered with the system. A user can check the complaint status. A user must send feedback after the petition complaint solved by same user login.

4)SUPER MODULE:

This module is about see the performance of admin and zone module in structural way. And after that make meeting in a month to keep updates about specific complaints

7.System Design:



7.1 System Design:

The diagram represents a simple flow for a web-based complaint registration system. Here's a brief explanation of each step in the system design

Web Portal: Users access the system through a web portal where they can register their complaints.

Register Complaint: This step involves the user providing details about their complaint through a form or an interface on the web portal.

Submit Complaint: Once the user has filled in the necessary details, they submit the complaint through the portal.

Complaint Received: The system acknowledges that the complaint has been received. This can include sending a confirmation to the user and recording the time of submission.

Stored Database: The complaint details are then stored in a database. This step may involve data validation, logging, and ensuring the complaint is correctly saved in the database.

Stored in Database: This final step indicates that the complaint information is securely stored and can be retrieved or processed further as needed

8. Testing:

Login Page

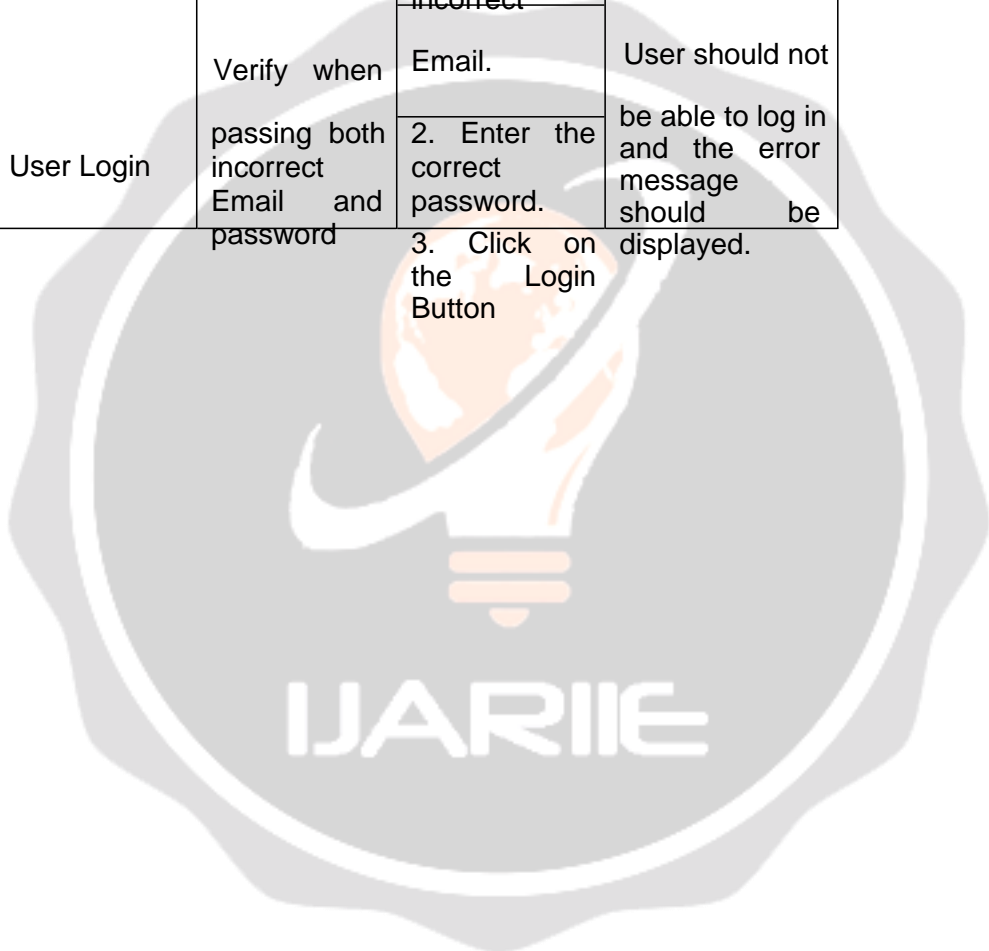
Test Case	Feature	Description	Steps	Expected Results
TC-01	User Interface	Check all the text boxes and buttons	Check Pages	UI should be perfect • Text boxes and button should be aligned
TC-02	Required Fields	Check the required fields by not filling any data.	1. Enter invalid username 2. Enter correct password 3. Click on Login Button	User should not log in and should show proper error message
TC-03	User Login	Check When passing a correct username and invalid password	1. Enter valid username 2. Enter incorrect password 3. Click on Login Button	User should not log in and should show proper error message

TC-04	User Interface	Check Keeping Password	<ol style="list-style-type: none"> 1. Enter valid username 2. Do not enter password 3. Click on Login Button 	User should not log in and should show proper error message
TC-05	User Login	Check when pass correct email and password	<ol style="list-style-type: none"> 1. Enter valid username 2. Enter valid password 	User should log in
TC-06	User Login	Check if the password is entered in encrypted	<ol style="list-style-type: none"> 3. Click on Login Button 1. Enter valid username 2. Enter password 	Password is entered in encrypted form
TC-07	Signup Option for new users	Check whether the signup link for the new user is working	<ol style="list-style-type: none"> 3. Click on Login Button <p>Click Signup link</p>	Clicking signup link takes the user to signup page successfully
TC-08	Forgot Password	Verify user should get an error message when he/she enters not registered email id.	<ol style="list-style-type: none"> 1. Click on the Forgot password link. 2. Enter unregistered email id and click on the send button. 	User should get an error message.

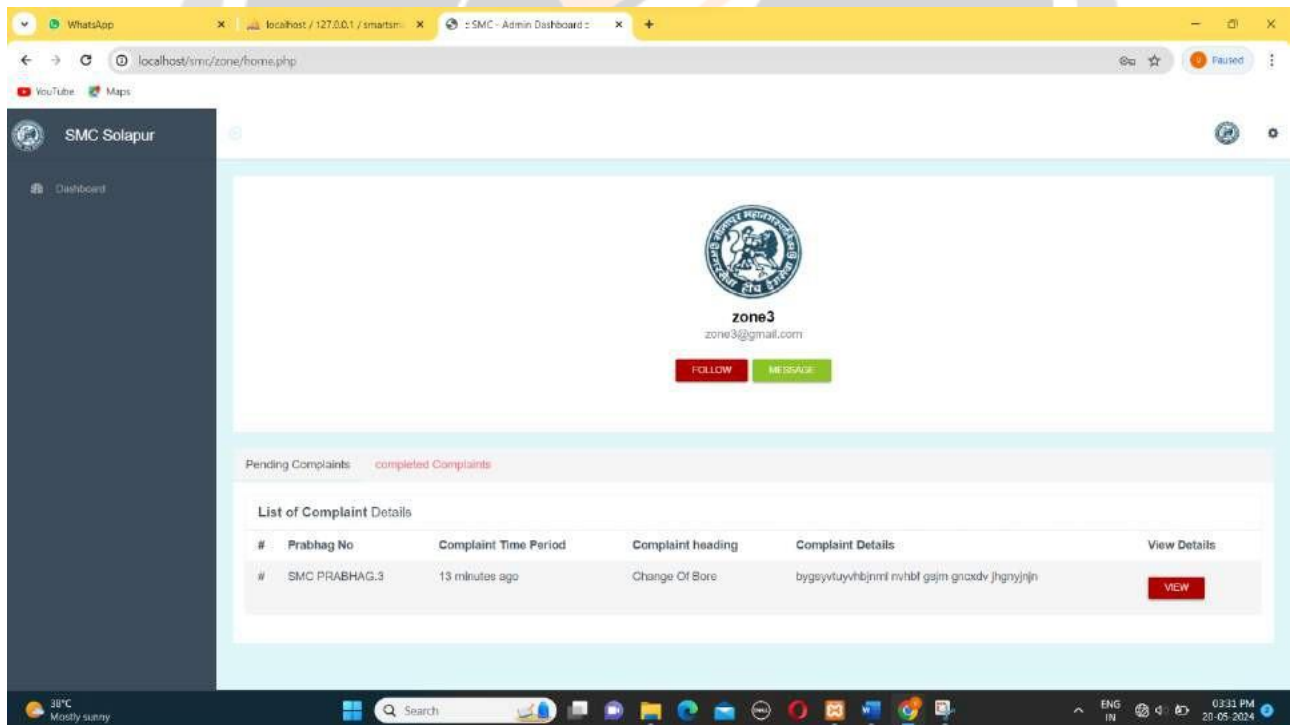
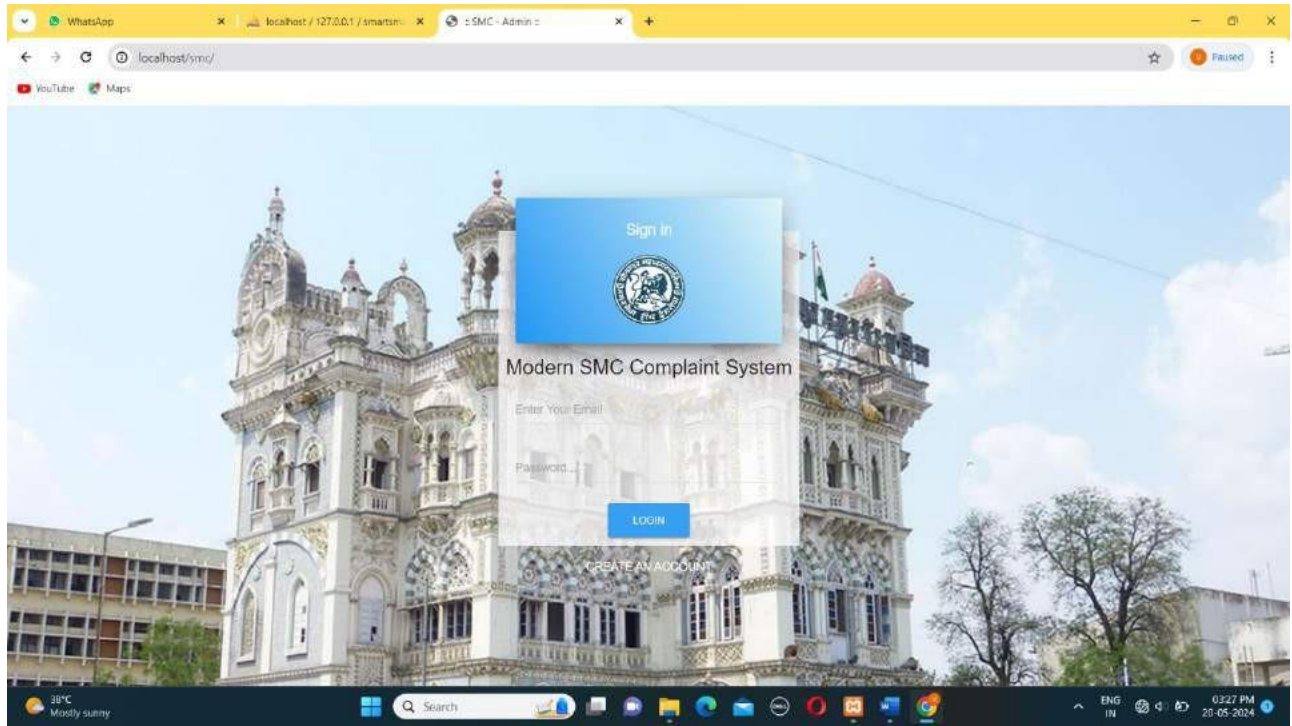
TC-09	Reset Password	Verify user should get an error message when he/she enters the previous password.	<ol style="list-style-type: none"> 1. Go to the reset password link. 2. Enter the previous password. 3. Click on the Reset Password button. 	User should get an error message.bhikgi
TC-10	Reset Password	Verify user able to reset his/her password	<ol style="list-style-type: none"> 1. Go to the reset password link. 2. Enter a new password and a confirm password. 3. Click on the Reset Password button. 	Users should get the success message and the password should get reset.
TC-11	Reset Password	Verify user should get an error message when password and confirm password not matches	<ol style="list-style-type: none"> 1. Go to the reset password link. 2. Enter a different new password and a confirm password. 3. Click on the Reset Password button. 	Users should get an error message.
TC-12	Reset Password	Verify user should able to login with a new	<ol style="list-style-type: none"> 1. Go to the reset password link. 	User should able to login

		password.	<ol style="list-style-type: none"> 2. Enter a new password and a confirm password. 3. Click on the Reset Password button. 4. Log in by using the new password. 	
TC-13	Reset Password	Verify if the user enters a new password that does not cover the basic requirements of password then the user should be displayed error message	<ol style="list-style-type: none"> 1. Go to the reset password link. 2. Enter a new password that does not cover the basic requirements. 3. Click on the Reset Password. 	Users should get an error message.
TC-14	Required Fields	Verify if blank spaces are passed in required fields.	<ol style="list-style-type: none"> 1. Go to the Site. 2. Passed blank spaces in required fields. 3. Click on the Login button 	Those Blank spaces should trim and Validation error message for required fields should visible.
TC-15	Welcome Email	Verify new users should get the welcome email once after the login.	<ol style="list-style-type: none"> 1. Go to the Email. 2. Enter Login Email. 	Users should get a welcome email on his/her email id.

TC-16	User Login	Verify when passing incorrect Email and correct password	<ol style="list-style-type: none"> 1. Enter incorrect Email. 2. Enter the correct password. 3. Click on the Login Button. 	User should not be able to log in and the error message should be displayed.
TC-17	User Login	Verify when passing both incorrect Email and password	<ol style="list-style-type: none"> 1. Enter incorrect Email. 2. Enter the correct password. 3. Click on the Login Button 	User should not be able to log in and the error message should be displayed.



9.Implementation details:



10.Result & Discutions

Machine learning is one of the latest branch in IT world.Machine learning we can train the machines through algorithm.under the machine learning therer is one sub part called data mining means select the particular data

from huge data this is called clustering algorithm so we used here modelbased clustering and k means algorithm

$$E = \sum_{i=1}^n \sum_{x \in c_i} |x - x_t|^2$$

E is the sum of the squared error of all objects in database. The distance of criterion function is Euclidean distance which is used for determining the nearest distance between each data objects and cluster center. The Euclidean distance between one vector X=(X1, X2Xn) and another vector

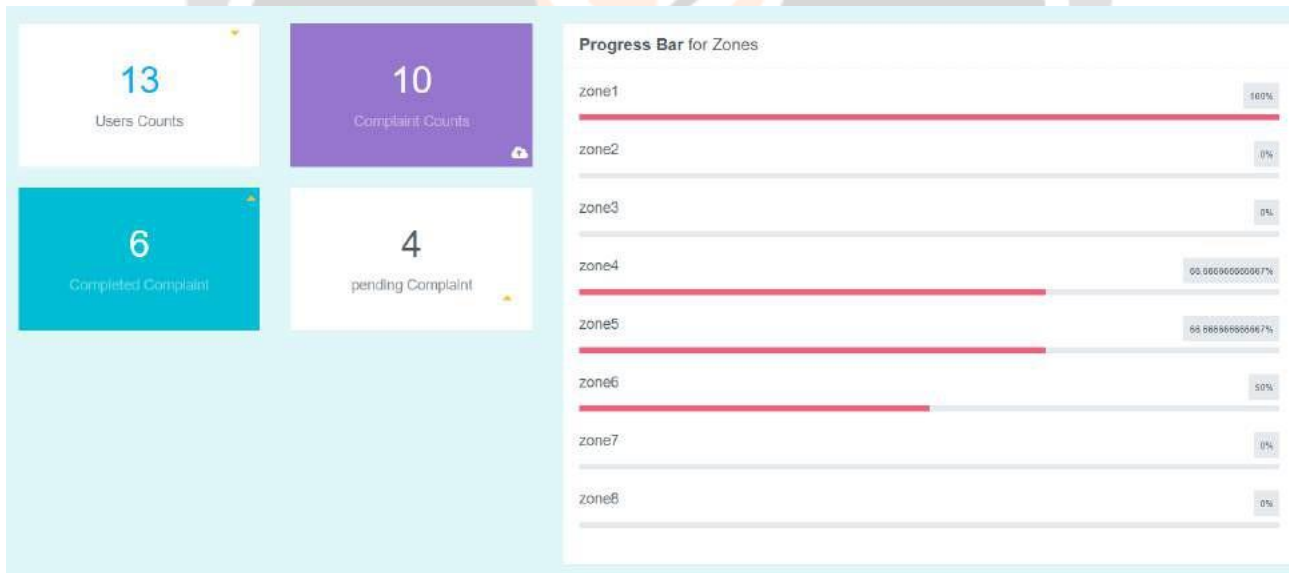
Y= (Y1, Y2Yn) .The Euclidean distance d (Xi, Yi) can be obtained as follow:

$$d(x_i, y_i) = [\sum_{i=1}^n (x_i - y_i)^2]^{1/2}$$

The process of K-Means algorithm as follows:

INPUT: Number of desired clusters K and a database D= {d1, d2... dn} Containing n data objects.

OUTPUT: A set of K clusters.



11.Future Scope

One possible future enhancement for a municipal corporation complaint detection app using machine learning could be implementing natural language processing (NLP) techniques to better understand and categorize the complaints. This could involve sentiment analysis to prioritize urgent complaints or topic modeling to identify emerging issues. Another potential enhancement could be incorporating image recognition technology to analyze images attached to complaints. This could help identify issues like potholes, damaged infrastructure, or illegal dumping more efficiently, allowing for quicker resolution of complaints.

Another valuable enhancement could involve implementing predictive analytics to forecast potential issues based on historical data. By analyzing patterns and trends in past complaints, the app could proactively identify areas prone to recurring problems, enabling the municipal corporation to take preemptive action to address issues before they escalate.

This app provides 24 X 7 availability and specially we provide counter from registration of complaint to completing that complaint so that user can see update whether their complaint resolved or not.

12.Conclusion:

In conclusion, the development of a municipal corporation complaint detection app utilizing machine learning offers a transformative solution to enhance civic engagement and streamline administrative processes. By leveraging machine learning algorithms, the app can efficiently categorize and prioritize incoming complaints, leading to faster response times and more effective resource allocation.

Furthermore, the app empowers citizens by providing them with a user-friendly platform to report issues in their communities, fostering transparency and accountability within the municipal corporation. Through continuous feedback and data analysis, the system can also identify trends and patterns, enabling proactive measures to address recurring issues and improve overall service delivery.

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