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Grievance Reporting System

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Abstract - *During current times when people are more connected and indulging in technology, our project uses this as the base to solve modern problems of grievance registration. The project modules are developed in such a way that it facilitates and ease the overall process of grievance registration to a minimum in order to save users time. Using this android application, users can capture images which will be then run through a machine learning model to calculate the severity of the image, for instance, high, medium, and low. During the image capturing process users, spatial location will also be registered to know the overall location of the issue one can then post the captured images with relevant descriptions, where they will be sent to a government body while also generating a grievance post that can be viewed and up-voted by fellow citizens. This can create a healthy pressure on the officials while simultaneously showing the citizens how efficiently the government officials are working on it, hence maintaining equilibrium.*

Key Words: **Grievance, Registration, Android, Severity, Up-vote, Spatial Location**

1. INTRODUCTION

With times technology has updated almost all practices and applications around us, making them more efficient, effective, and affordable but government systems like the grievance registration systems still stand a bit primitive due to the fact that we still have to manually add our own locations, lack of ways to analyze the grievances, etc. to name a few. For instance, the Wrong insertion of spatial location can cause misunderstandings and unwanted delays for the officials. Even when the solutions of these problems are already present like GPS location to track the spatial location and Machine learning algorithms for analysis. The power of officials in certain terms is limited so we addressed it and tried to solve issues of user participation in our application using a portal where fellow users can post their grievances but instead of them being viewed just by the officials it would be added into a portal where fellow users can see it and up-vote it or like it if they are facing the same issue. Resulting in a reduction of redundancy and an increase in the number of issues posted, as such portals keep the public engaged and also help them find a sense of belongingness and fulfillment of contributing towards the betterment of society.

2. LITERATURE SURVEY

A. GPS-based complaint redressal system

Vishesh K. Kandhari et.al created an android application that locates the spatial location of the user when he registers a complaint, it locates the spatial location of the user using Google Maps API. The other addition of the author is the sub-system which forwards the grievance to the upper management if a certain amount of time passes. [1]

B. Architecture of a GPS-Based Road Management System

Yoon Yeh Tan, Yin Ping Ng, Kim Nee Goh, Yoke Yie Chen, and Kamaruzaman Jusoff et.al developed a system that sends the location of the user along with the description when one registers a grievance to server and stores it inside a database. The application can then retrieve the location and plot it on a map. [2]

C. A Survey of Image Classification Methods and Techniques

Siddhartha Sankar Nath, Jajnyaseni Kar, Girish Mishra, Sayan Chakraborty published a research paper that explains the concept of Image classification, its prospects, and also the various techniques one can use to execute it along with their respective pros and cons. [3]

D. Convolutional Neural Networks for Image Classification and Captioning

Sachin Padmanabhan published a paper that explains the use of CNN and its implementation of CNN architecture in Image classification along with its neural network layers. It also compares the performance of other algorithms and then compares it to that of CNN. [4]

E. Implementation of Location based Services in Android using GPS and Web Services

Manav Singhal and A. Shukla published a paper that proposes the implementation of GPS and web services through Walk Score transit APIs and Google Web Services on Android devices, additionally it also discusses the various services provided to the user through it. [5]

Table 1: Summary of the Literature survey

SR No.	Paper	Advantages and Disadvantages
1	Vishesh K. Kandhari [1]	Advantages: The automatic tracking of spatial location removes the issue of human error. The sending of grievances to the upper management after a fixed interval of time creates a proper accountability factor for each complaint. Disadvantages: 1. In terms of innovation it is limited to spatial location no other important functionality is provided by the application hence making the overall scope quite limited.
2	Yoon Yeh Tan, Yin Ping Ng, Kim Nee Goh, Yoke Yie Chen and Kamaruzaman Jusoff [2]	Advantages: 1. The spatial locations are stored into a database that is easy to manage and keep a track of. 2. Android application in the paper retrieves the spatial location, which is in a string of numbers format and then converts it into a graphical format through a Map which makes it easier for the user to understand. Disadvantages: 1. Similarly other than spatial detection and registration system related to road systems no other domains are covered.
3	Siddhartha Sankar Nath, Jajnyaseni Kar, Girish Mishra, Sayan Chakraborty [3]	Advantages: 1. The categorization of the scene will help in efficient and rapid analysis of the surroundings. 2. Numerous images are classified in a much quicker way so that accessibility is easier and faster. Disadvantages: 1. We cannot estimate or map the results of a new sample. 2. Varying results are obtained due to outliers.
4	Sachin Padmanabhan [4]	Advantages: 1. Better captioning is achieved as the image captioning uses Black box systems. Disadvantages: 1. Only the concept of the image classification was discussed, but no implementation of a real application was shown.
5	Manav Singhal and A. Shukla [5]	Advantages: 1. A-GPS utilized has pinpoint accuracy in regards to spatial location detection. Disadvantages: 1. GPS satellite signals do not penetrate building interiors well.

3. PROPOSED SYSTEM

3.1 Grievance Registration Application

Grievance registration App was developed using (programming languages). In this App once the user has successfully created an account and logged in, they will come across a portal that will display a summary of grievances posted by users like them; here the user has the privilege to comment on it or up-vote it to show his support, in case he faces the same issues. Whenever the user first logs in and opens the home page its spatial location will get registered and that will be dynamic as it is subjected to changes, whenever the user opens the home page again after a fixed interval of time. Grievances will be displayed in a card layout format so that the user can glance through them in rapid succession, clicking on them for more information on the grievance will lead them to a new tab where additional details about the grievance will be shown, for instance, its image, the spatial location of the problem, the description, number of up-votes, its status, Score and other miscellaneous details like date of its registering, etc. The spatial location taken allowed us to display the location of the problem on the Map using an API, it makes the task of tracking and getting the estimation of the place where the grievance is situated easier for the human mind (i.e., Government officials) to interpret, due to its graphical format. The Navigation bar provided, holds 3 functions namely, the home button which holds all the grievances posted by fellow users which were mentioned before. Secondly, the add grievance button, and finally the User Profile button.

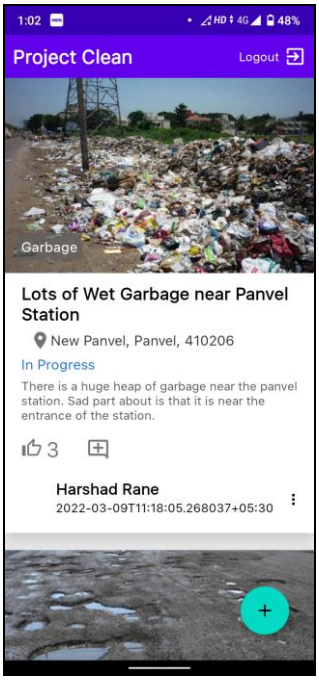


Fig 3.1.1 Home Screen

Fig. 3.1.2 grievance registration

The add grievance button allows them to click the image of the encountered issues, for example, a heap of garbage.
He then has to Click the image of it using his phone camera, add the title, description and category of it from the drop-down list, the spatial location of the place where, the image was captured would also be recorded automatically helping the user avoid the tedious task of manually typing it while also preventing inaccuracies due to human-error. After filling the necessary fields, the user needs to submit it to successfully register it in the Government database, from where the needed actions will be performed on it. In case the user does not want to click an image of the grievance for some reason then he has the freedom to do so as well. After performing the action, users registered grievance will be displayed on the home page and be ready to be up-voted or be commented on. Lastly, the User-profile button, it's the place where user can perform editing actions on his personal details or simply Log out of his account.

3.2 Government Web Application

On the government's side, every employee will be provided credentials of his registered account using which they can log in to the Web Application. These accounts will hold different privileges, for instance the landing page (Home) will consist of a dashboard that will display all the statistics of the grievances, like number of issues resolved, still pending, their total numbers etc. Using these figures, the officials can track their progress and can gain some insight into the data to facilitate decisions regarding it (Example: the analysis of data can help in budget estimation). The website can be roughly divided into 2 sectors; one is public sector (Municipal) where all officials can look at the cumulative progress and statistics of all grievances. The other is personalized section, which an official can enter after clicking on my workspace button.
In Municipal section other than statistics one can view registered Grievances that come from the Android application and perform various actions on it. There are multiple Filters put in place to filter the grievances on different parameters like Number of Up votes, Category, status, location etc. There are 4 statuses that could be assigned to a grievance, first one is registered, and this status is given after the successful registration of the grievance by the user through the android application. Second is Pending status, which signifies that no person as of yet has been assigned to your grievance. Thirdly, In Progress this status depicts that a government official has undertaken your grievance and is working on it. Finally, the rejected status, this status signifies that for some valid reason your grievance has been rejected by the officials and they won't be working on it, the reason will also be provided by them. The privilege of assigning these statues is given to officials when they move the grievance from public section to their personal workspace.

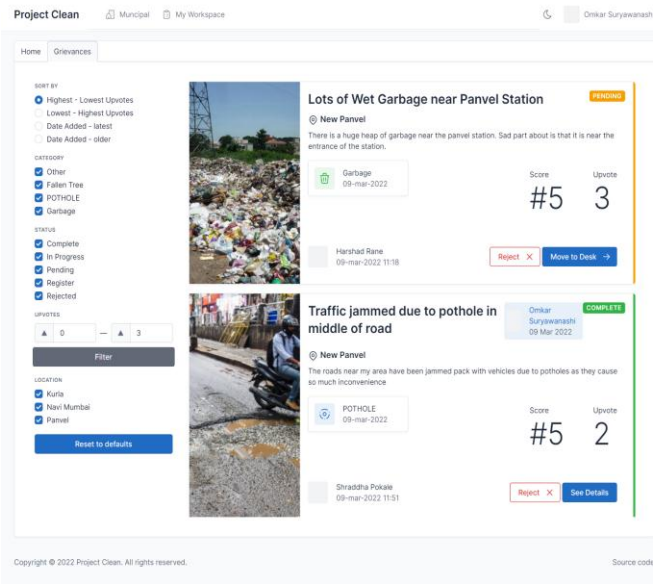


Fig 3.1.3 Web Application dashboard

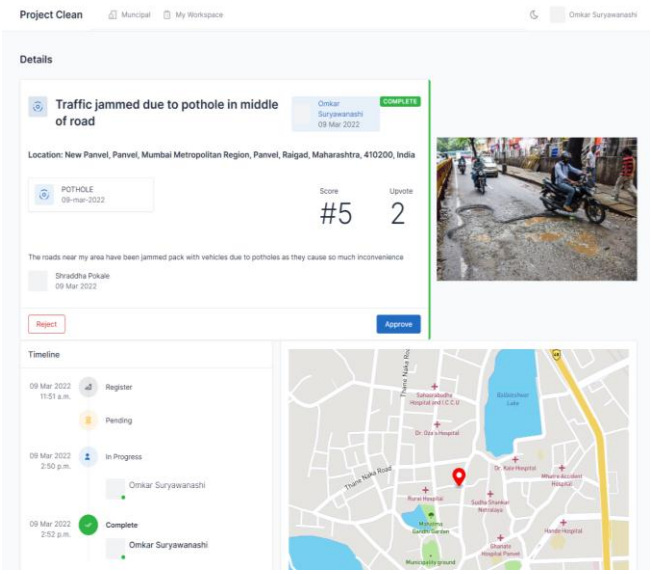


Fig 3.1.4 Grievance detail page

My Workspace has a Desk section that acts like a personal virtual desk for the user where he can create or manage files with ease. Inside these files will be the grievance that were selected by him from public area and brought here so he can work on it. As soon as the official does so his name is registered with the grievance, displaying the exact time and date when he started working on it along with his name. This eases the job of upper echelons as the overall progress of each employee gets tracked and people could be held accountable for their work.

3.3 Scoring Criteria

The Score which is displayed on each grievance plays a vital role in helping the officials Prioritize the grievances, in total there are 4 distinct functions used to calculate this score. Which are Number of days (The older the grievance, higher the weightage), Category (Some categories are considered more important than the rest, for instance, Garbage will have more weight than Fallen Tress), Severity, this parameter is calculated by a CNN model that calculates the severity of a grievance through the image which is provided by the user Between 0 to 1, where 0 is lowest 0.5 is medium and 1 is highest (Example: a small heap of garbage could have a severity of 0.1, on the other hand, a large heap of garbage could have the severity of 0.9), the final function used to calculate score is Number of Up votes(higher the upvotes higher the priority).The Score roughly divides all the grievances into categories of #1 all the way to #10, #1 being the ones with the highest priority and succeeding ones having lower, all the way to #10 which is the lowest.

3.4 Image Classification for Grievance Severity

In TensorFlow Keras library, layer and model were used. After pre-processing, we used sequential models with 2 CNN layers and a dense network of 2 layers.

3.4.1 Pre-Processing

The RGB type image is converted to a grayscale image and Re-Sized into a 200 X 200 pixel image. Then the provided image is flattened into a NumPy array of float values. Following this, the values are divided by 255 in order to reduce the computation power required to process it. Labels are assigned with 0 as low, 1 as medium, and 2 as high respectively. The datasets are randomly Split with 20% of them being utilized as test Datasets and the other 80% as training Datasets.

3.4.2 CNN Layers

Here the CNN layer consisted of the Convolution layer and Max pooling layer. In the first convolution layer we considered 32 filters having a size of 3x3 with activation function being relu, input shape was 200 X 200 X 1, and Max Pooling with pool size 2 X 2.
For the second Convolution layer, we selected 64 filters with size being 3 X 3, its activation function as relu, and Max Pooling with pool size 2 X 2.

3.4.3 Dense Network

In the Dense network for the first layer we selected 64 neurons and activation function as relu and in the second layer we considered 3 neurons while activation function being softmax. To compile the model we used the 'adam' optimizer and 'sparse_categorical_crossentropy' for loss. The CNN model was trained up to 10 epochs.

3.5 Normalization

The Range of Input Values (ideally):

Criterions	Range
No. of upvotes	0 - ∞
Severity	0 - 2
Category Value	1 - 3
No. of days passed	0 - ∞

Number of votes ideally is infinite but in real life applications we have to convert it into finite, so in order to do so we considered the Total number of users registered in that particular area as the upper limit. Similarly in the criterion No. of days passed, if the status of any grievance does not change after 30 days it will be assigned special status directly.

The Range of Input Values (Realistically):

Criterions	Range
No. of upvotes	0 - N
Severity	0 - 2
Category Value	1 - 3
No. of days passed	0 - 30

Where N = Total number of users in that city.
In regards to the Category value, Certain categories hold more importance than others and hence should hold more weight. We have assigned the following weights to the Categories.

Category	Value
Garbage	1
Pothole	2
Fallen Trees	3

Here all the scores will be converted into a range of 0-10

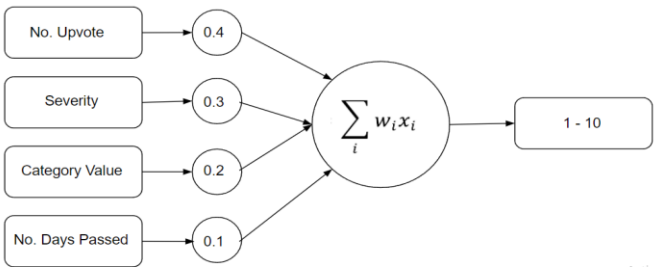
$$x' = ((x - x_{min})/(x_{max} - x_{min})) * 10$$

For the below instance No. of upvotes range from 0 to 200

	Input Value	Normalised Value
No. Upvotes	168	8.40
Severity	1	5.0
Category Value	3	10.0
No. Days Passed	22	7.241379

3.6 Weighted Scoring Model

Weight is assigned to each criterion based on its relative importance. The formula of Weighted Scoring Model:



	Weight	Raw Input Value		Normalize Input Value		Weighted Value	
		Post 1	Post 2	Post 1	Post 2	Post 1	Post 2
No. Upvote	40%	168	37	8.40	1.85	3.36	0.74
Severity	30%	1	0	5.0	0.0	1.5	0
Category Value	20%	3	1	10.0	0.0	2	0
No. Days Passed	10%	22	10	7.24 13	3.10 34	0.72 413	0.31 034
						7.58 ≅ 8	1.05 ≅ 2

3.7 Requirement Analysis

A. Software

Operating System	Windows 7/Mac OS and above versions, Android 5.0+
Programming Language	Python,Kotlin,CSS,Javascript,HTML,XML
Database	PostgrSQL

B. Hardware

Processor	2 GHz Intel
HDD	180 GB
RAM	2 GB
Camera	2 MP

3.8 Datasets

In the fallen tree category, we have collected 579 images for the dataset. They are further divided into three sub-categories: low, medium, and high.

Category	Low	Medium	High	Total
Garbage	456	298	234	988
Pothole	218	207	242	667
Fallen Trees	96	172	311	579

4. RESULT ANALYSIS

Here we display data that has gone through data visualization, which helps workers get a better real-time understanding of the overall operation in terms of the grievance statuses. Some of the graphs utilized to display data are line graphs, pie charts, etc.

We have created a dashboard for all these graphs, which will help government officials understand and track the total number of grievances, their statuses, amount of increases or decreases within different time periods, etc. This will help in the planning of a number of things like Budget estimation, appropriate delegation of duties, and suitable distribution of human resources among the task force.

5. CONCLUSION

This project is our approach to making the existing system more efficient, robust and detailed which was done with the help of different modules that we implemented and are thus illustrated in the report. The application also has unique functions like the scoring function, a unique priority function that will calculate the grievance ranking using different parameters and will thus help in ranking the grievances in turn helping the officials to sort out more important ones from the rest. Nowadays, when technology is constantly evolving, even a little innovation can make a huge social impact which we tried to do through the means of our project.

6. ACKNOWLEDGEMENT

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