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CIVIX

A Crowdsourced Civic Issue Reporting and Resolution System

[1]Mrs.Y.Ashwini, [2]Mir Ayan Ali, [3]MD Shoaib Ahmed, [4]Mohammed Abdul Mugees

[1]Professor, [2]Student, [3]Student, [4]Student

[1]Department of Computer Science Engineering,

[1]Methodist College of Engineering and Technology, Hyderabad, India

Abstract:

In the context of developing and largely populated countries, civic issue reporting and redressal can be extremely challenging and difficult to navigate for both citizens and the concerned authorities. Most official reporting channels are fragmented, difficult to use and lack modern technologies which could actively make them better. Even when reported thoroughly, the verification of resolutions remains a challenge. CiviX enables both authorities and citizens on a single AI (Artificial Intelligence) powered mobile application through a common shared complaint dashboard wherein, complaints and resolution can be verified through images (Computer Vision) and exact GPS (Geographic Information Systems) coordinates. We ought to make registering of complaints easier by integrating NLP (Natural Language Processing) to enable voice based complaints in multiple languages and ML (Machine Learning) for intelligent routing to concerned department, this combined with a social media feed like dashboard which could be combined with Data Analytics to directly assist in public governance related decision making. CiviX is also designed to keep the user experience clean, simple, and easy to navigate. The application aims to increase accessibility, transparency, accountability, confidentiality (by allowing Anonymous complaints and private accounts). This is an experiment and a possible solution to better public governance, especially in rapidly growing cities assisting both the government and the citizens in creating a better society around them.

Keywords - Artificial Intelligence, Computer Vision, Geographic Information Systems, Data Analytics, Public Governance

I. INTRODUCTION

In mega cities of developing nations with large populace, it is increasingly difficult to report everyday civic issues such as broken streetlights, overflowing drainages, potholes etc. Citizens use formal, informal and semi-formal channels to report these issues. Formal channels include using official government portals and apps; these online services are active and useful, but they are sometimes difficult to navigate with overwhelming and complex User Interface (UI). On ground people with an educational background and with hold on the English language use the online portals and apps. Formal channels also include the offices of various government departments and registering complaints in-person; citizens may encounter high waiting times, and this may cost both the authorities and citizens time and cost.

Informal channels include social media, local media, and news channels, community groups, or local influencers. An example of semi-formal channels is a citizen contacting a government official directly

who had previously worked in their locality on ground. While these channels do help people, they are not very accessible considering the above methodology. Plus, all these channels are not entirely transparent, with proof of resolution being optional to non-existent. These channels of reporting can also cause redundant complaints when the same issue is faced by multiple people.

Hence, a lack of accountability occurs leading to the dismay of both authorities and citizens. If both wings of society are not on the same page, it leads to frustration, especially for the citizens, and leaves them feeling unheard.

To maintain the trust and effective cooperation between the authorities and citizens CiviX runs on four major pillars that are Accessibility, Transparency, Confidentiality and Accountability. These ensure that everyone is on the same page and build trust and reduce confusion. Leading to quicker turn-around times, happier citizens and stronger governance, ultimately leading to development.

II. LITERATURE REVIEW

A literature survey is vital to understand the depth, scope, and potential critiques surrounding our project idea and to fulfill its implementation successfully. We have reviewed and mentioned papers exploring the proposed features that we want to include in our application.

First, starting off with complaint classification, we have understood that manual categorization and priority assignment are inefficient and maybe tedious for the user. Hence, we searched for ways to streamline the process and explored the use of NLP (Natural Language Processing) to automate complaint classification and reducing the manual effort required (Jain et.al, 2021). Further explored the idea based directly on our theme of citizen-based grievances (Chaturvedi & Reddy,2020).

Images serve as an integral part of our system to further automate the complaint classification process. We could directly use models to classify the complaints based on the input image (Kaur & Sharma, 2022). This will directly improve the efficiency of the application and improve the clarity and response time for the user involved.

Location usage is the backbone of our proposed application as the verification and resolving of an issue is directly done through the exact location coordinates using a GIS (Geographic Information System) and Geospatial technologies. Leveraging this technology to visualize and analyze areas based on complaints and resolutions (Ahmed & Basu, 2020) can directly influence public governance and high-level decision making.

Towards the end of our reading, we observed further evidence on the use of AI in enhancing public administration (Srivastava & Mehta, 2023). We also came across the concerns related to data privacy and overall security with the increasing use of AI systems as an overall concern as well as concern specific to goverance (Patel & Desai, 2022).

Despite all these findings, there is still a big gap in redressal systems, specifying a need for a transparent, accessible app that maintains confidentiality and safely uses data and reports to influence public policy and governance.

Table II.1: Analysis of existing complaint management systems

Title	Authors	Methodology	Advantages	Metrics	Future Work
NLP Complaint Classification	Dipika Verma, Manikandan Thevar, Rani Mario	NLP , TF-IDF , ML	Automates complaint categorization	Accuracy, F1	Multilingual and Transformers
Public Complaint Classification	Alfina Dian Febyani, I Kadek Dwi Nuryana	NLP , TF-IDF , ML	Handles multiple categories	Accuracy, F1	Deep learning & incremental learning
Complaint Routing System	Subhash S. Mokase, Vijay Kumar, Sandip Rathod	NLP , LSTM , rule routing	Reduces manual effort	Accuracy	Robust DL & adaptive routing
Word2Vec Complaint Classification	Mohit Rathore, Dikshant Gupta, Dinabandhu Bhandari	Word2Vec , ML	Flexible text input	Accuracy	Transformers, voice-to-text
Voice Complaint Classification	Rachana S. Rao, Suhasi G S, Rakshitha M	Speech-to-text , NLP , ML	Supports voice input	Accuracy	Multi-language support
Healthcare Complaint Classification	Xiadong Li, Qiang Shu, Canhong Kong	NLP , SVM	High accuracy in hospitals	Accuracy (~0.91)	Extend to other domains
Public Complaint Mining	Samsul Bahri, Ema Utami, Asro Nasiri	Text mining , ML	Handles imbalanced data	Accuracy, F1	ML-DL hybrid models
Multimodal Complaint Classification	Rishu K. Singh, Navneet Shreya, Sarmistha Das	Text , Image , Transformer	Handles multimodal input	Accuracy	Larger datasets & languages
Smart City Complaint App	Farhatun Shama, Abdul Aziz, Lamisa Bintee Mizan Deya	Mobile , DL classifier	Real-time capture & classification	F1, User feedback	CV verification, GIS mapping

III. COMPARATIVE ANALYSIS

Comparison between CiviX and traditional systems has been made briefly in the Introduction (I) section through the four pillars of CiviX application that are Accessibility, Transparency, Accountability, Confidentiality. In comparative analysis, we ought to dive deeper between the differences spanning across different stages of the app from reporting complaints to using data for decision making. The first major difference can be seen when a new complaint is being lodged. Traditional systems include manual classification, phone calls or form filling at times, basically tedious processes that are inefficient with regards to modern technology.

CiviX mitigates this by using NLP and ML based routing and categorizing complaints, making the process smoother, faster and more efficient. The resolution part of CiviX is unique; we have a location specific system that requires proof of resolution (image) within the 10-meter radius of the exact coordinates where the complaint was lodged from using proof of reporting (also an image). This creates a verification system that works based on Geographic Information System, with the support of Google Maps that act as the redirect portal to show the exact coordinates on the map, so that the concerned authorities may reach to the exact location.

All the complaints made are displayed in the form of a public dashboard with 'open' and 'resolved' tags displaying which complaints were solved and which are still in need of assistance. This dashboard contains a social media feed curated according to the location of the user; it contains an upvote button on each complaint increasing user engagement and helping in prioritizing the complaints. When two or more users lodge a complaint within the same 10-meter radius, the first of these complaints is automatically upvoted, thereby reducing redundancy.

Lastly, CiviX includes privacy-based systems including the choice between a private and public account for citizens and allowing anonymous complaints. We also have a complaint map feature that acts as a heatmap of complaints shown across the map which can be integrated with data analytics to directly help in public governance and decision making.

Table III.1: Feature-wise comparison of civic complaint management systems

Feature / Aspect	Traditional Civic Complaint Systems	AI-Powered Systems (Literature)	CiviX (Proposed System)
Complaint Submission	Manual forms, phone calls, emails	Mobile/web forms, basic NLP for text classification	Mobile-friendly app; photo and audio submission; real-time GPS tagging; STT transcription
Complaint Routing & Classification	Manual routing; misrouted complaints common	ML/NLP-based automated routing; limited integration	AI-driven NLP plus Gemini model auto-classification; department prediction
Transparency & Tracking	Citizens cannot track complaint status; low visibility	Dashboards showing complaint counts; basic status updates	Public dashboard; real-time status updates; trending complaints; upvotes for visibility
Resolution Verification & Feedback	Manual closure; low accountability	Some systems use textual confirmation or basic follow-up	Mandatory resolution image upload by authority; geospatial verification; complaint closure validation

IV. RESEARCH GAPS IDENTIFIED

1. **Lack of a Transparent System:** Majority of the redressal systems are not transparent with proof of resolution being optional and no scope of a real time complaint feed.
2. **Lack of Input Modes:** Most platforms do not support the use of mulitple modes of input like voice, text, images etc. CiviX is designed to handle multiple input modes in multiple languages for ease of use and appealing to a wider customer base.
3. **Inefficient Manual routing:** Many channels of reporting work on manual routing and categorization, increasing inefficiency and effecting user experience.
4. **Use of GIS:** Only few systems make the use of GIS (Geographic Information System) to provide the exact geographic coordinates of the issue at hand.
5. **Complex User Interface:** Majority redressal systems have complex user interface that overwhelms the user and makes it difficult to interact with the system
6. **Minimal Privacy System:** Usually, a user is expected to share their private info before lodging a complaint and there is no scope of private accounts or anonymous posting.

7. **Lack of User Engagement Features:** Most official channels do not allow collaborative complaints where users can comment or upvote (like) each other's posting making it a very personal experience rather than shared.
8. **Limited Multilingual Support:** Many application struggle to provide support of multiple languages and do not use NLP for transcribing and translation.

V. PROPOSED SYSTEM

The proposed system, **CiviX**, is a user-centric mobile application that aims to improve traditional methods of civic issue reporting and resolution systems by creating a centralized system for both citizens and authorities on the same application using a common complaint dashboard, wherein complaints are marked as 'open' or 'resolved' based on a valid visual proof of resolution backed by precise location coordinates.

To start, CiviX first asks the user for certain media permission including camera, microphone and location, wherein location is a compulsory permission which is to be allowed by the user for the functioning of the application. The citizen can choose either a private or public account during the creation of an account. Further, when a complaint is to be lodged the citizen submits a proof of reporting in the form of an image and a description of the problem which is automatically routed to the concerned department using NLP (Natural Language Processing) and ML (Machine Learning).

In case of difficulty in textual description, users may record audio, which gets translated and transcribed by Google Speech API; the GPS coordinates are automatically fetched (subject to location sharing being allowed by the user). All the complaints lodged are stored in a robust backend system that accepts various modes of data stored in different tables and buckets.

The authority interface also includes a public dashboard that specifies the number of complaints by dividing them into 'open', 'In Progress' and 'Resolved' categories. The authority account cannot be created directly by the user and is instead assigned to the concerned individual directly by the application department-wise. The authority portal also includes an analytics dashboard giving insights into area-wise metrics in order to improve the level of governance and make appropriate decisions. When an authority wants to close a particular complaint, a proof of resolution in the form of an image within the 10-metre radius of the original complaint must be made, this allows the complaint to be resolved.

Hence, the complaint moves from the 'open' tag to 'resolved' tag updating its status and reflecting in both the citizen dashboard and authority dashboard. The authorities also have the option of resolution history acting as a directory for closed complaints.

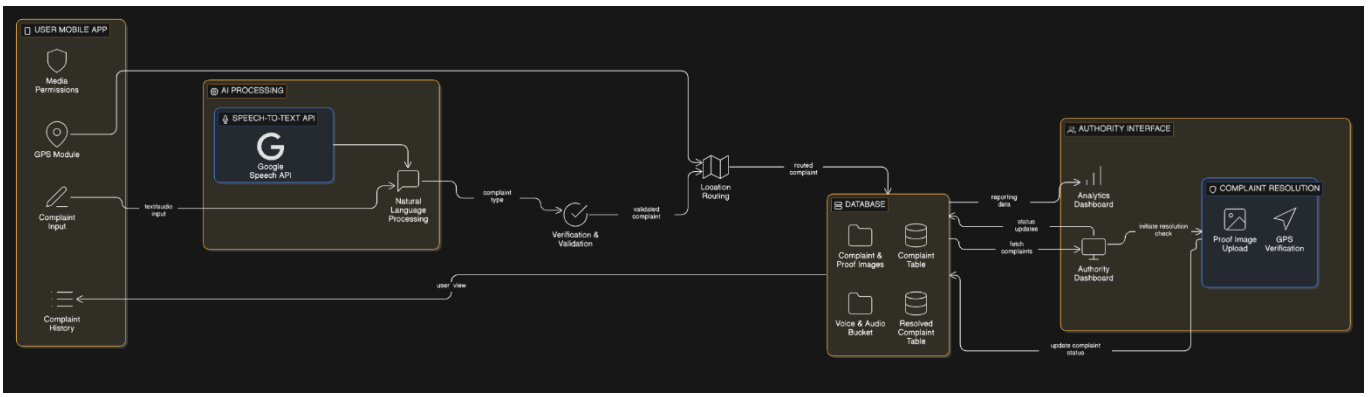

Figure 1: System Architecture

VI. RESULTS AND DISCUSSION

CiviX emerges as a serious, better equipped alternative to existing grievance redressal systems, by integrating Artificial Intelligence (AI), NLP (Natural Language Processing), Machine Learning (ML), GIS (Geographic Information System) to create an app supporting accessibility, transparency, accountability and confidentiality.

From the citizens perspective it allows multi-modal inputs, automatic complaint routing and categorization, a fully transparent live complaint dashboard, verifiable proof of resolution from the authorities along with privacy-based systems and visual mapping-systems for complaint tracking across areas. It also encourages user engagement through upvoting and social media like feed.

For authorities CiviX introduces a greater sense of accountability, establishes trust with the citizens as proof of resolution is mandatory. The analytics dashboard helps authorities understand the needs of the user and take decisions accordingly. The upvoting systems make prioritization easier, leading to efficient allocation of resources as per need and level of urgency.

Despite these accolades, CiviX still has a variety of challenges to face, including continuous refinement of the NLP model to maintain accuracy across various linguistic landscapes, a scalable backend infrastructure capable of supporting multimedia data and high level of privacy as citizen information is extremely sensitive.

With the right amount of support and backing CiviX could overcome these hurdles and become a truly citizen-centric app and also directly help authorities navigate the challenging path of public governance and decision making.

We envision an engaging, easy to use, effective and impactful application, capable of making everyday citizen life better, and provide direct assistance to authorities in the quest for making citizens lives better.

VII. CHALLENGES

1. **Managing Multimedia Data:** Managing data across images, audio and text in different formats and sizes can be challenging.
2. **Description Ambiguity:** sparse or incorrect descriptions may lead to classification and routing problems.
3. **Multilingual Support:** Transcribing and translating multiple languages can be difficult and costly.
4. **Scalable Backend Infrastructure:** Having a scalable backend supporting constant flow of complaints and associated data can be difficult to maintain.
5. **Citizen Data Privacy:** Protecting sensitive citizen records from possible mishaps is key, in grievance redressal systems.
6. **Full Government Support:** It is difficult to seek government support on such transparent apps with anonymous posting
7. **Crowdsourcing:** The entire concept of CiviX works by the active participation and crowdsourcing of complaints by responsible citizens. Thus, a large customer base who actively contribute is an absolute must.

VIII. FUTURE ENHANCEMENTS

1. **Predicting Issues: Using** Data Science and predictive AI to make calculated possibilities of potential issues that might take place.
2. **Using IoT:** Using sensors in civic infrastructure at higher risk of failure (eg: *streetlights, drainage systems*) to effectively mitigate potential problems.

3. **Advanced Multilingual Support:** Develop ways to include various dialects and languages, providing ease of use and a sense of familiarity.
4. **Cross-Department Collaboration:** Enable collaboration and coordination between various departments for issues involving multiple departments, ensuring smooth resolution.
5. **Data Driven Policy Making:** Data inferred from the complaints can be used to make calculated decision for the betterment of society at large. Thus, creating a public policy based on actual on ground metrics.

IX. CONCLUSION

This review highlights the need of a citizen centric mobile application, making use modern day technology to better the lives of citizens and make governance easier by establishing trust between the two through a transparent, accessible and engaging app with an easy-to-use interface supported by multimedia data, multiple languages, privacy-based systems and data integration to help directly in governance, increasing accountability. Therefore, CiviX aims to ultimately create a positive impact improving everyday citizen lives and directly contributing in better decision making from authorities.

The potential for data integration in context of CiviX is immense, with the right analytical tools and models CiviX could act as a digital advisor on specific issues of civic nature and assist in the allocation of resources, come up with strategies, collaborate with on-ground workers.

With the growing awareness of 'civic sense' among the masses Civix can also be used a platform for increasing engagement among the citizens by conducting in app events, challenges, rewards etc
This would further elevate the platform to be truly citizen-centric and more than an urban grievance redressal app.

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