



READY RECKONER

ICT BASED ADAPTATION TO CLIMATE
CHANGE IN INDIAN CITIES

As a federally owned enterprise, GIZ supports the German Government in achieving its objectives in the field of international cooperation for sustainable development.

Published by

Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices

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GIZ is responsible for the content of this publication
New Delhi, India, 2022

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1. Ready Reckoner



Overview

The purpose of this document is a Ready Reckoner about the method of developing ICT based digital solutions like Mu City Savior and Flood Free Kochi and give an overview of the process will help in developing similar digital solutions for the benefit of citizens and the government alike. These digital solutions have been developed as ICT based tools to help the administrations of the two cities Bhubaneswar and Kochi dealing with urban flooding due to rapid climate changes. The solution not only helps the citizens to report the water logging areas to the municipal corporations but also helps the municipal corporations to prioritize action based on ranking given by the software. This ensures timely action on critical areas, as well as use of limited resources by the authorities.

Easy Adaptation

The solutions presented in to the document can be easily adapted to the needs and wants of existing urban cities which are already burdened with huge populations and their demand on resources. It can be also adopted for new and upcoming smart cities that are being planned with latest technological advancement for basic facilities of human need.

To illustrate this better, once the citizen identifies a certain drain or road/area with water logging issues, he/she can report it to a central command centre with the help of the Application on his mobile phone, which can help the authorities to resolve the issue by deploying workforce to the reported spot, according to the priority. The priority of the complaint is decided at the command centre and passed on to the designated supervisor to be acted upon.

This is particularly useful in times of monsoons because with rapidly changing weather patterns due to global warming, the cities are experiencing excessive and irregular rainfalls, leading to widespread issues of inconvenience. Over a period of time, data that is gathered on the central dashboard by the municipal authorities can be analysed and informed strategies can be developed for future urban planning.

2. Steps To Develop A Similar Solution



City Selection



Based on the internal discussions of the central developing agency with the government and authorities concerned, cities or pilot areas can be selected for the project. Authorities can take help of Rapid Assessment Test to take a decision. The cities for this particular project were selected in 2016 by joint working groups of Indo German governments as part of their bilateral collaboration to fight climate change together. The expert teams carried out rapid assessment based on several scientific, local and technical parameters for city selection.

Conduct Rapid Assessment

A rapid assessment research helps great deal in determining the best area or city suitable for the project like above. For rapid selection of partner cities for ICT-based adaptation to climate change. The research was conducted on the following parameters:

1. Climate Risk and Data
2. Climate Adaptation
3. ICT Presence in City Government
4. ICT Innovation Ecosystem

These parameters can be further divided into several sub categories based on the discussions and then each city/area can be marked on these parameters. To conduct Rapid Assessment, subject experts need to visit the selected cities to conduct quick overview of situations, meet stakeholders, do ground level surveys along with site visits etc. The cities or areas emerging in ascending order of marking can be selected depending upon the number of cities or areas that are to be worked on. A further SWOT analysis can help cement the decision.

To illustrate for the selection of the cities for the current project, the rapid assessment was conducted between three cities of Kochi in Kerala, Bhubaneswar in Odisha and Coimbatore in Tamil Nadu on the given parameters of climate risk, climate adaptation, digital penetration in city government and presence of ICT innovation system. It was noted that Bhubaneswar tops the climate risk index but is also technically, the most prepared in terms of climate adaptation practices, presence of digital solutions in governance and has a robust ICT innovation ecosystem, which made it the top contender for the project.

Identify The Various Stakeholders

Once the selection of cities or areas is done as per the discussions with the government and rapid assessment research, the next task is to identify necessary stakeholders within the city whose close cooperation would be required for the successful completion of the project. Some of these could be:

Possible Stakeholders:



Hold An Inception Or Icebreaker Meeting



After the identification of the stake holders, organize an 'Inception' or an icebreaker meeting between all the stakeholders in the presence of 'Inception Leader' who can steer the meeting. In the inception meeting, the stakeholders can brainstorm on several challenges that the city faces due to climate change and possible solutions for them. By the end of the inception meeting the stake holders with the help of the inception leader should be able to come out with the possible problem that they would like to work upon. In this case it was urban flooding.

Reach A Common Aim: City, Climate Change And ICT-A (GIZ)

The stakeholders should now jointly decide the common aims of the project. Here, the aim of the project is to encourage citizens of the selected cities to jointly come up with a digital solution along with stakeholders to better deal with urban flooding (as decided in inception meeting) in rainy seasons. This would enable state governments and local authorities to integrate evidence-based climate change adaptation into urban development methodologies by drawing upon innovative solutions in order to collect and analyse data.

Identify The Pilot Areas

Identify the pilot areas in the cities as per internal discussions with the agencies involved based on the identified problem, common aims and the final outcome of the project which is to develop ICT based solutions.

We can illustrate this better with the Mu City Savior solution example. Two pilot areas were finalized from a list of 56 previously identified low lying areas that were prone to flooding due to various natural or man-made reasons, as informed by Bhubaneswar Municipal Corporation to the team. For the pilot project, stakeholders chose the areas of Satabadi Nagar and Nayapalli in Bhubaneswar based on inception research conducted at the beginning of the project. Both these areas have an extensive network of drains that often get choked or flooded due to various reasons.

3. Scrum

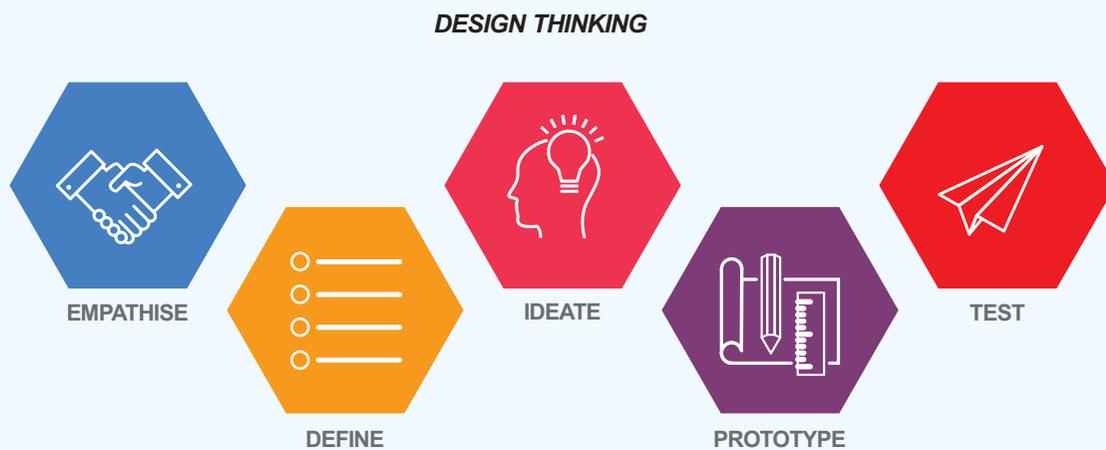
The Scrum process is an important process to develop trust between the stakeholders and the technical and resource teams of the project. An ideal Scrum process is based on the values of courage, commitment, focus, openness and respect for stakeholders from the resource team's side. The inception workshop served as the first ice breaking workshop between the stake holders and the resource team and it helped the resource team understand the needs and expectations of the policy makers of the city, many crucial decisions were taken regarding the entire project in the same workshop.

The technical resource team built the necessary structure of the digital solution in Sprint 1 and Sprint 2 and went to the stakeholders again after the completion of the structure to take approval and feedback for the same. This gave the stakeholders reassurance about the entire working of the resource team and they were able to engage with the team regarding any feedback and suggestions for the project directly. It gave them a great sense of ownership towards the project as well. Scrum ensures a constant feedback loop with the key stakeholders decision makers and the technical resource teams.

The resource team too was headed by a Scrum master who was adept in handling the team through the entire process of the Sprints and Scrum. He worked and motivated the entire team on the core values of courage, commitment, focus, openness and respect that form the basis of the Scrum process.



4. Methodology Adopted To Devise The Application



A multipronged approach is to be devised to develop an ICT based solution from the inputs received by the team in inception workshop by various stakeholders. For this particular ICT based solution, 'Design Thinking Approach' is incorporated to bring out the inputs from the stakeholders, followed by SPRINTS with the digital solution developing teams and finally extensive in-house and on-ground testing before releasing the final products for the public. Design Thinking is the central process of the digital solution development and it involves 5 key stages - Empathise, Define, Ideate, Prototype and Test. We need to further divide this into two phases before moving into SPRINTS for better coordination.

Design Thinking Approach: Phase 1

In Phase 1 of Design Thinking, focus needs to be on two aspects of the design process:

Stage 1: Empathy Research

Stage 2: Problem Definition

Stage 1: Empathy Research

The team needs to conduct Empathy Research which is the first part of Design Thinking Process that derives greatly from human behaviour and psychology. The goal is to understand the feelings of people and Appreciate the problems they face by engaging in informal communication, interviews and background research on the given issue at hand. Empathy Research helps us in getting a deeper insight into user's experiences, expectations and motivations. It helps in breaking the ice between the user and designer or team.

For Empathy Research for any city, following stakeholders must be involved in the Design Thinking Process. More stakeholders may be identified as per the Individual city demands:

1. Municipal Corporation Officials
2. Indian Meteorological Department Officials
3. Smart City Officials
4. Citizens and NGOs
5. Drain Cleaning Agencies
6. Emergency Services like Fire Control, Disaster Management among others

Interview representatives of the above stakeholding organisation at length and discuss their issues with city's flood situation and the problems faced by them. Note down the detailed feedback of each stakeholder as each feedback will be different from the other on the same topic of urban flooding. The feedback can vary from lack of equipment and manpower to low resolution of complaints, narrow lanes for large vehicles to enter etc. This will provide a basic foundation to work upon the digital solution.

Stage 2: Problem Definition

Once data from Empathy Research is collected, present it to the stakeholders in systemized form that can help them deduce some problem areas which need further evaluation for making the ICT based solution. In making of the Application for Bhubaneswar these 3 problem areas were identified after the Empathy Research on urban flooding:

1. Flood Prevention
2. Flood Damage Minimization
3. Flood Response



Now, the area with the highest priority for development of ICT based solution from the above mentioned problem areas due to urban flooding needs to be finalised. This can be achieved with the help of a critical evaluation done with all the stakeholders and taking their feedback on the same. This is illustrated with the help of the example given below for the solution developed for Bhubaneswar.



The Empathic Research with the municipal corporation officials revealed that almost all choked drains had two common agents viz. garbage and silt. Therefore, a mechanism that could be adopted to identify these drains on priority could help get them cleaned sooner, and thus avoid the risk of floods to bare minimum. This would also help the municipal corporations in keeping track of the complaints for future references, as well as keep a track of cleaning agencies. It was observed that at present the corporations start to clean all the city drains simultaneously without a priority plan and therefore, often tend to miss the necessary areas.



It was explored if a system can be put in place or not, which could tell the citizens of the city of expected heavy rains and therefore, possible flood like situations at short duration of two hours. On further exploration it was realised although the technology for this task exists for larger cities, but has not been implemented for small areas of one municipality and therefore, would not be feasible.



Flood response has two components:

- a) Citizen reporting to the authorities about flood like situations wherein they call on a centralised number to a representative, who further coordinates the resolution to be taken.
- b) A temporary task force that is raised only during the flood time of the year that deals with all calls for help from citizens.

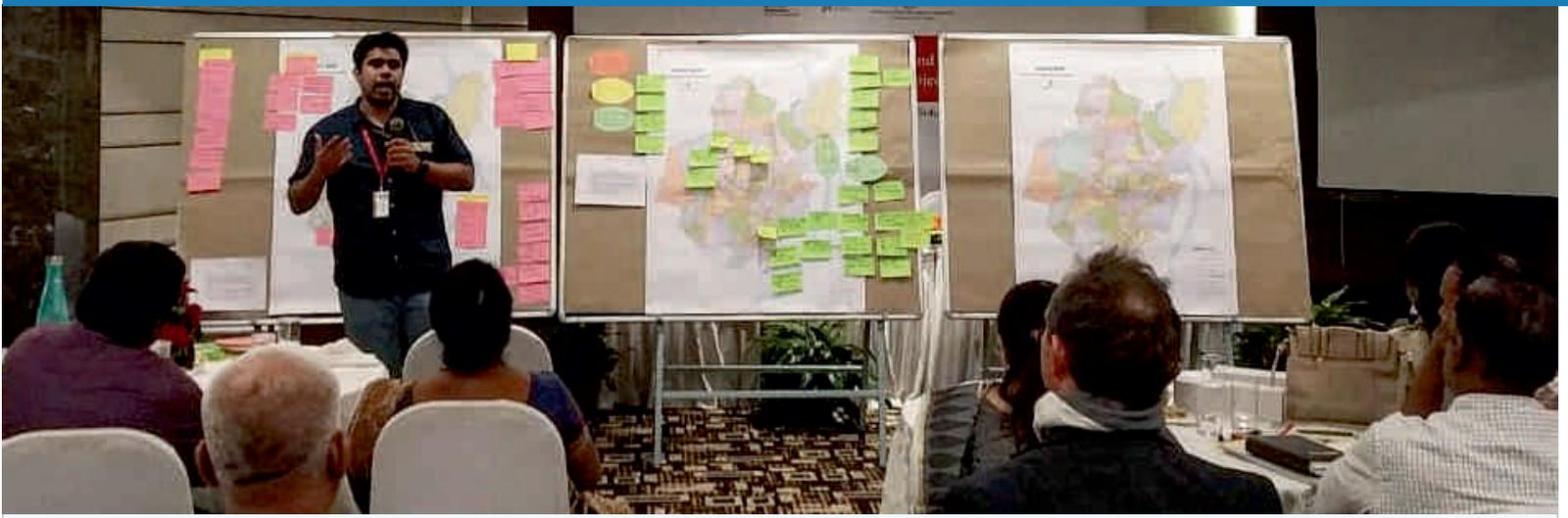
Both the above points have their limitations of communication gap, feasibility, coordination issues and therefore, were dropped from the line of thought of ICT-Application.

Keeping in view all three problem definition areas as arrived after due deliberations and considerations, it was decided to work upon the first problem area of 'Flood Prevention' with the help of ICT based Application, as flood prevention seemed like an area that not only would nip the problem in the bud, but also set an example to replicate, in almost all other Indian cities. The discussion may also help in unearthing the reasons for blockages of drains as well, in any city.

Stage 3: Ideation



A minimum of 2 SPRINTS need to be organized for developing the digital solution. A SPRINT as the name suggests is a tight run program strategy adopted to achieve the desired goal within a short span of time. It is usually undertaken for not more than a period of 1 month. The SPRINT may involve field visits, discussions, brain storming, strategising, creating etc. It is always followed by a rigorous round of feedback from the participants and stakeholders, that helps further the project, as well as improve upon the work done in the SPRINT. It also helps in identifying the need of another SPRINT for the same project, if any.



SPRINT 1

The SPRINT 1 was organized as part of the Design Thinking methodology after narrowing down the problem of flood prevention in Stage 2 above. This stage helps us get closer to the goal of developing the ICT based solution for the problem, as defined in Stage 2.

Organise a 6 day joint workshop of all the stakeholders like the municipal corporation, meteorological department, citizens, NGOs, local drain cleaning agencies and the local fire department and any other relevant agency to the project. The aim of the SPRINT should be to further narrow down the work areas and develop the concrete models of prototypes of the ICT solution. All kinds of discussions, brainstorming and questions should be encouraged in the workshop.

In the workshop, begin by defining common problem statement with the help of participation of all the stakeholders. This will help all the stakeholders to get clarity for the entire project duration to keep focussed on the issue. To illustrate this better, the following problem statement came out with the participation of all stakeholders:

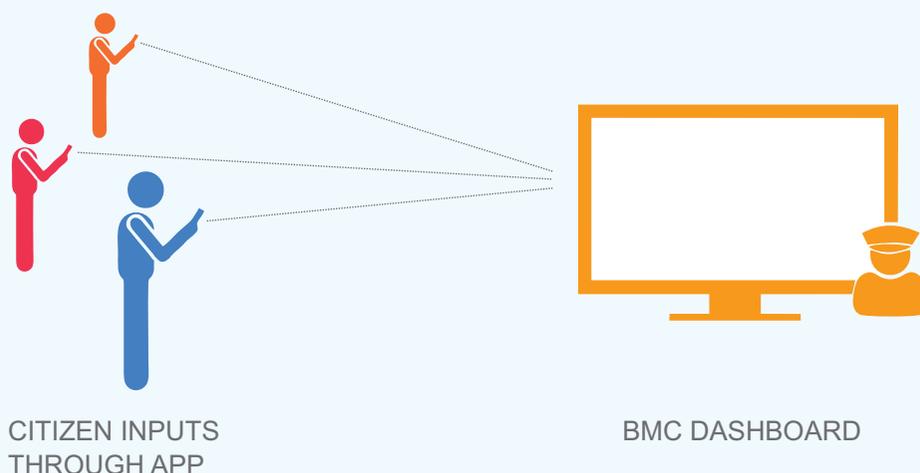
“How best to help the Bhubaneswar Municipal Corporation officials in finding out the drain flow situation in real-time and live settings so as to enable them to optimise their resource personal for easy, timely and priority based resolution of the same, helping the city and citizens avoid a flood like situation in the process.”

You will see, that by keeping the above problem statement in mind, by the end of the day, many ideas towards the drain problem situation in the city will be presented. All ideas should be made welcome.

Refining The Design Ideas Generated In The Workshop

The design ideas will then need to be further refined in consultation with the technical teams and stakeholders. At this stage, you will be able to clearly see the idea of developing the ICT Based Application that would help the citizens of the city to give inputs to the Municipal Corporation officials. The final idea entailed that the information from the solution would be displayed on an electronic dashboard at the centralised control room for BMC officials, where they would see the real-time, live and dynamic status of the critical spots identified and pre-marked through GPS on the Application by end users or citizens. Amongst these ideas, select the best ideas for prototyping and discard the rest.

From these ideas, select the best solution for the prototype stage, which is the next stage:

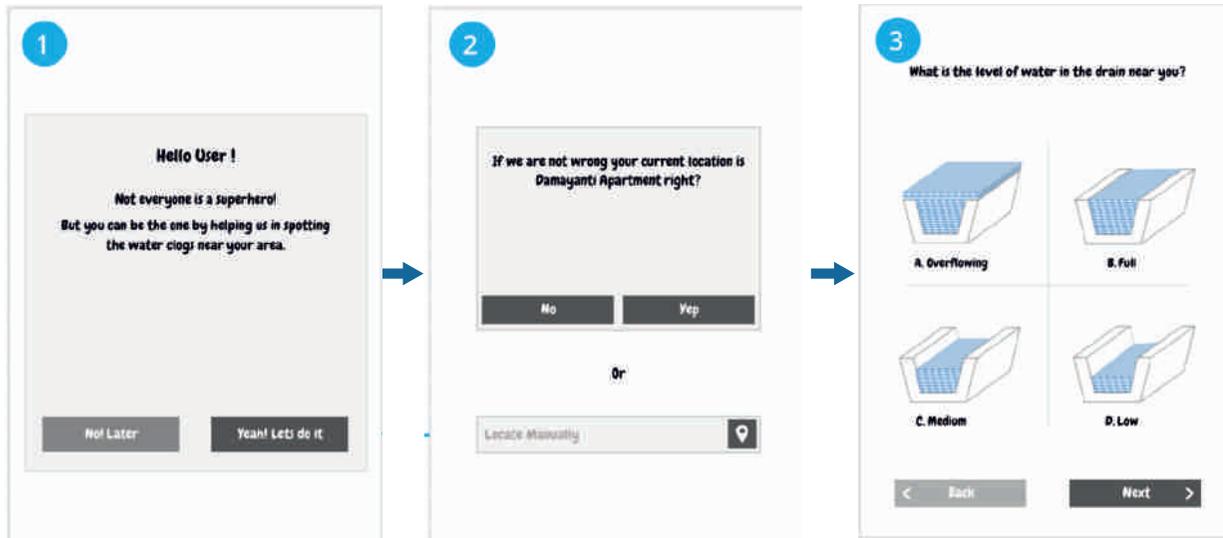


Stage 4: Prototyping And Testing

Dummy prototype of the selected idea needs to be made in this stage. This can be the first mock-up version of the selected idea. After the feedback, new versions will need to be made. An illustrated example has been shown below:

Citizen's App Prototype V1

Once the citizen identifies the blockage in the drain, he will be shown the following on the screen:



Screen 1 and 2: The App shows notification prompting contribution and confirms location of the user
 Screen 3 and 4: Questions about the drain level and speed pop up



Screen 5 and 6: Further questions on garbage and rainfall received are asked

Testing The Application (App) And Taking Feedback



Taking Feedback is an extremely important part of the whole exercise as it helps us in knowing if we are on the right track and changes if any, need to be made or not. Teams that participate in the SPRINT will need to be sent to designated areas for testing of the prototypes. They need to explain to the citizens and Municipality officials how the App prototype works, so as to take actual on-site working feedback from them.

5. User Feedback; Points To Keep In Mind

Take up to 3 rounds of feedback for the App prototype, refine the prototype each time with the feedback received before heading for the next round of feedback.

- **First Round of Feedback on Citizen's App**
- **Second Round of Feedback on Citizen's App**
- **Third Round of Feedback on Citizen's App**



Based on the above feedback with citizens a realisation dawned on the stakeholders to involve willing volunteers for the solution testing in SPRINT 2.0. It was also decided to gamify the solution to make it more interesting for the young users involvement. Each city may have its share of lessons and realisations which can be customized and accommodated accordingly.

The idea of volunteers was justified because:

- Volunteers are better motivated to sign up for the App as the cause appeals to them
- Trustworthiness is improved
- Likelihood of accurate response increases as self-interest does not govern the response

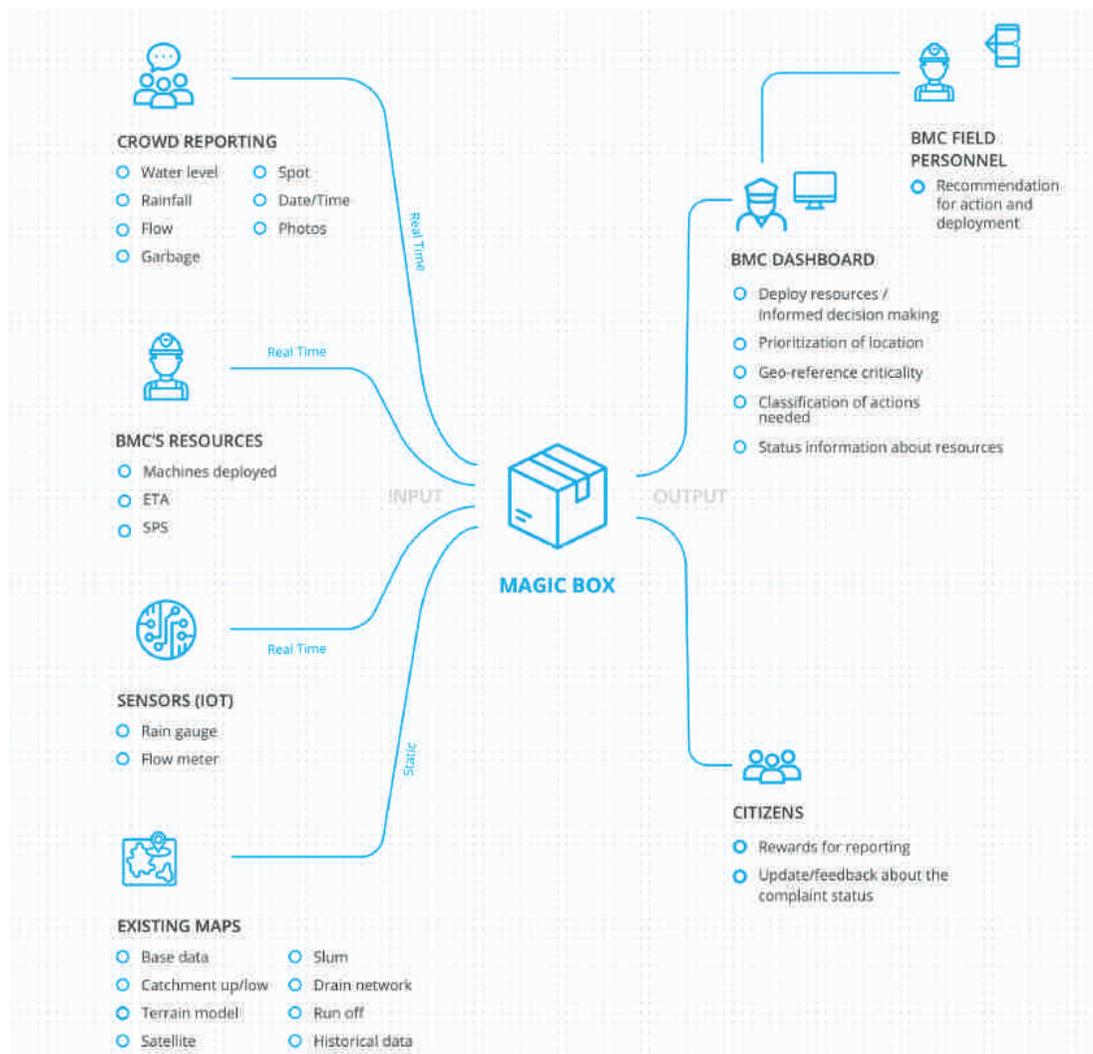
Feedback on the BMC Dashboard

Similarly, the development of prototype of Bhubaneswar Municipal Corporation Dashboard will also need to be checked by municipal corporation officials. Usually one round of feedback is enough at this stage.

6. The Solution Concept: Gamification



The idea to convert the solution in a game format came at this stage as it helps the young volunteers to engage with the tool more. It was decided to keep the volunteer age between 15-24 years, to test the prototype that will be developed as per feedback in SPRINT 1, as this age group is tech savvy. It was also decided to gamify the Application, which meant to create an interface that has a story with characters that is easily relatable with the target audience, as well as makes it interesting to the user. For gamification in this App, it was decided that the tasks related to reporting the condition of the drains will be abstracted to a mission in the game, where volunteers would need to walk to the location of the drain and then identify the critical spots to mark the condition of the drain by either of the two methods of picture survey or clip art survey.



Final deliberations with the GIZ and Technical Teams will help the agencies develop the solution concept. For the Bhubaneswar ICT solution, the concept is as under:

“The solution comprises of a centralised system that gathers information related to the drain status from the various sources like citizens (through crowdsourcing App), IOT sensors, rain gauge etc. and predicts the criticality level of the spots. This information can be accessed by BMC on the dashboard designed for it. The Municipal Corporation can use this information to guide their field officials and take necessary actions to prevent or control the flood.”

7. SPRINT 2

SPRINT 2 will help in creating the actual solution with the help of technical developers and core stakeholders or program agencies. The application developed here will be known as Version 2 (V 2.0). The technical, creative and core teams need to sit together and introduce the work done so far to each other. This will help them understand each other's role and work. The decisions for the way to develop the solution can be taken here and way forward can be decided amongst the teams. Once the strategy is developed, the various lessons learnt from different feedbacks, issues can be incorporated in the solution. An example of this process is given below from the Mu City Savior solution.

Redesigning The Critical Spot Markers

It was identified that the critical spot markers in SPRINT 1.0 were not clear. They were non descriptive and were difficult to spot as per users. It was therefore decided to make them slightly more detailed with bright colours and with more written description so as to make the reader understand the situation easily. After taking the feedback on the Spot Marker Prototype V1 and making some further improvements, a revised design was made and Approved.



Spot Marker designed in SPRINT 1



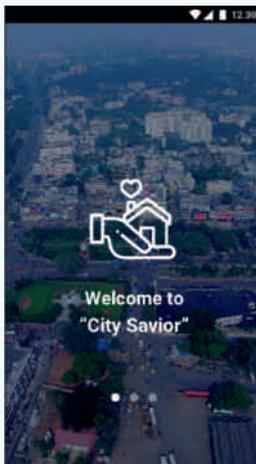
Spot Marker designed in SPRINT 2

Finalise the solution as per the feedback And Test the Solution:

Test the application Version 2.0 with the chosen volunteers in the age group of 15-24, at least two times on the following parameters:

- What is the better representation of the drain situation on the application: Picture method or Clip art method?
- Were the users able to follow the instructions in the application and act accordingly?
- What were the hiccups in using the application?
- What is the feedback of the users on the gamification of the entire application?

Final Mock-Up Of Application After Sprint 2.0



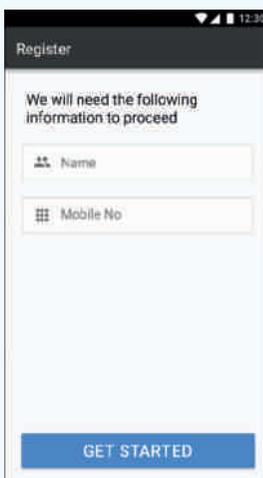
Welcome



App Background
(About the App)



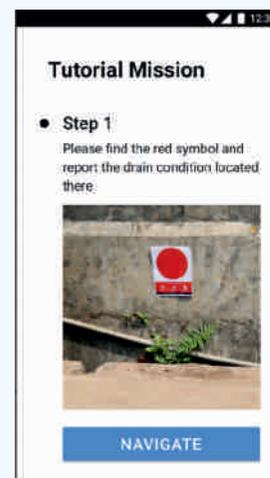
How it Works



Registration



Play Game



Step 1 of mission

8. Uniting The Design And Technical Team

Concurring On The Feasibility And Viability Aspect Of The Entire Solution Concept

- Base data needed as input for the computerised analysis and recommendation
- The technical development experts based on the expectations, drafted a plan of action to gather that data needed and a working draft for the pilot

Scope And Depth Of GIS Survey

- For the final pilot App to be developed, a better mapping of the length and breadth of the area defined that needed to be included in the App, including all the major and minor drains to be covered in the same. This was then shortlisted by technical team
- Some of the indicators like population, number of houses, industries, slums to be measured, surveyed and modeled, were agreed upon with technical team
- Finally, to get the required data of the drainage network, permissions and collaborations with the BMC were also sought by GIZ and technical team
- Time and resource needed were also estimated

Logic Development For Ranking Of The Critical Spots

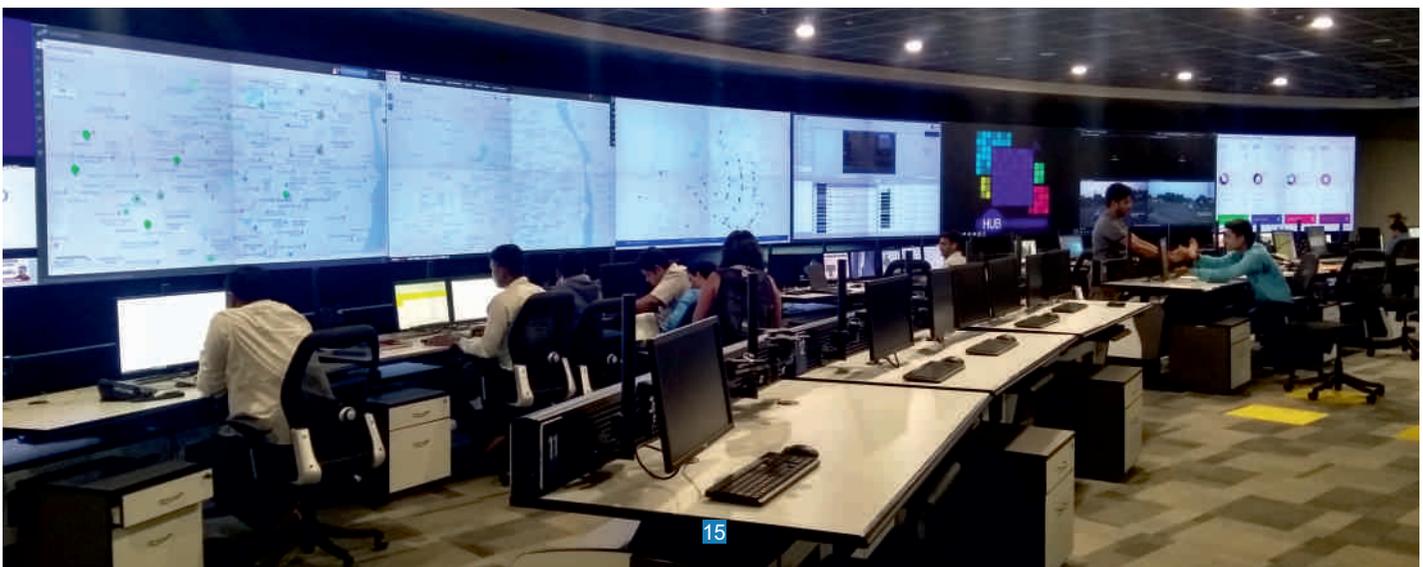


The technical team needs to explain the software logic to be developed for the ranking of the critical spots to be seen by the Municipal Corporation officials on their dashboard to decide the order of criticality of drains and hence, order of rescue or drain cleaning operations. The discussions on weight of each factor for the purpose of ranking needs to be discussed, clarified and frozen. Then a roadmap for the development of software logic can be prepared.

Mobile Application And Web Platform Development



The software developers and UI/UX designers from technical teams also need to be briefed on the expectations of the desirability aspect of the volunteer App and the dashboard for Municipal Corporation officials before the beginning of the process. Based on the deliverables, the developing team needs to get their questions cleared and make a roadmap for the software development, assessing which software codes are already available in their development libraries and which ones would need to be freshly written.



9. Mu City Savior: An Example Of ICT Innovation For Smarter Cities



The Mu City Savior digital solution is developed, keeping in mind the flooding situation in the Bhubaneswar city. The digital solution is youth oriented for 15-24 year young adolescents who are tech friendly and keen to change the city for the better. They are outgoing, mobile and it is easy for them to operate the digital solution. The digital solution has gamified the reporting tasks, where the volunteers get points and ranking for reporting on the conditions of the pre-selected spot of the drain system. The digital solution guides the volunteers to those locations and these locations are pre-marked with a visual marker.

Next, with the help of a reference picture, the volunteer identifies the current status of water flow in the drain, the garbage levels in the drain and then taps the “report” button. This information is then sent to Bhubaneswar Municipal Corporation Dashboard for further analysis. For each report, the volunteers gain virtual points, which increase their ranking in the game.

The end to end solution developed by technical teams consisted of four different components:

1. Crowd Reporting App
2. Geo Information System
3. Analysis System
4. Display Dashboard (Including Mobile App Version)

The individual components of the system are explained as follows:

Geo Information System (GIS)

As the name suggests, the Geo Information System provides information on the geography of a particular territory. Besides basic information about the topography, land use, population and roads etc, GIS developed specifically for the App will also have information about the drainage system network (including critical spots), vulnerability map which displays the static relative risk ranking of the critical spots due to their geo-locations and the hydrological model of the city.



Analysis System (Ranking Model)

The algorithm of analysis system will analyse the input data from the Mu City Savior App and the GIS to sort and prioritize (rank) the critical spots. This will help in recommendations about the order in which these spots are to be cleaned and those can be displayed to the BMC. The drains will be ranked in order of their urgency in cleaning. The ranking model will consider the vulnerability of the area, the hydrological criticality and real time information about the flow status of the drain.

The output of the model is a clear ranking of the critical spots, which will be displayed on the Bhubaneswar Municipal Corporation (BMC) dashboard. This will help BMC to prioritize resources for drain cleaning. In the near future, the analysis system will be able to predict the flooding and help the planning authorities to sustainably plan the city infrastructure as well.

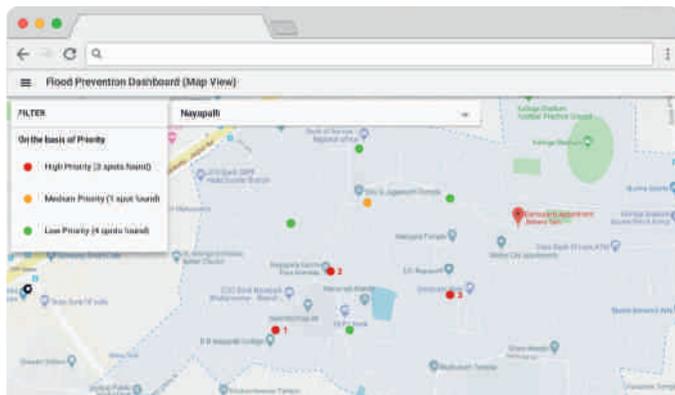
Display Dashboard & Mobile Application

The dashboard displays the recommendations of the analysis system to the Bhubaneswar Municipal Corporation officials. Each critical spot is visualised with its cleaning priority ranking and a colour code for a specific action is assigned as follows:

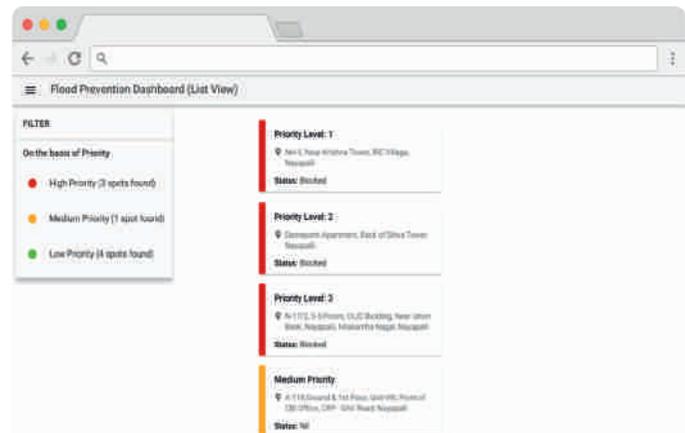
- Red - Urgent cleaning required.
- Yellow - Regular cleaning required
- Green - No cleaning action required

The city officials can utilise this information to improve the management of the cleaning and maintenance of the drains in order to prevent the flood situation. Beside the dashboard, a mobile application will support supervisors to control the critical spots and mark the cleaning status of the drain. The information will be fed back into the analysis system and will update the overall system.

Mock-Ups Of BMC Dashboard

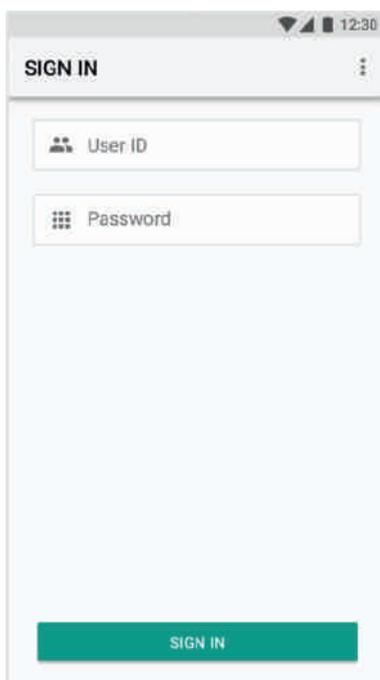


Map view

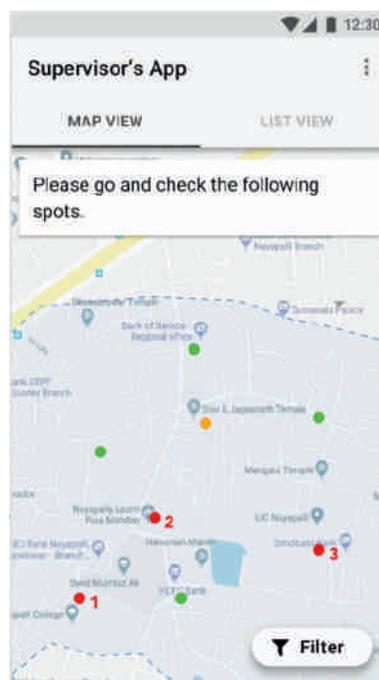


List view

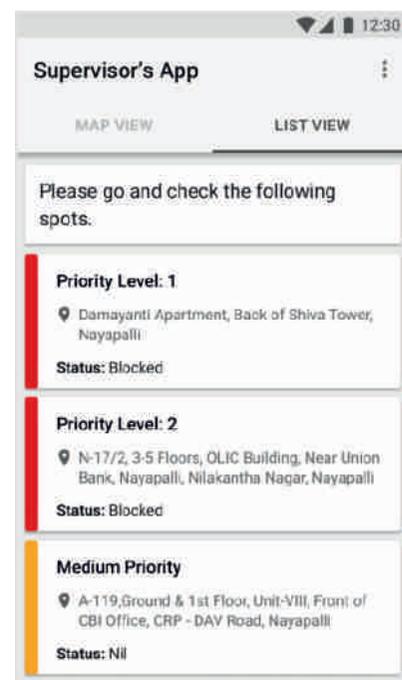
Mock-Ups Of BMC Supervisor App



Log in



Map view



List view

10. Way Forward

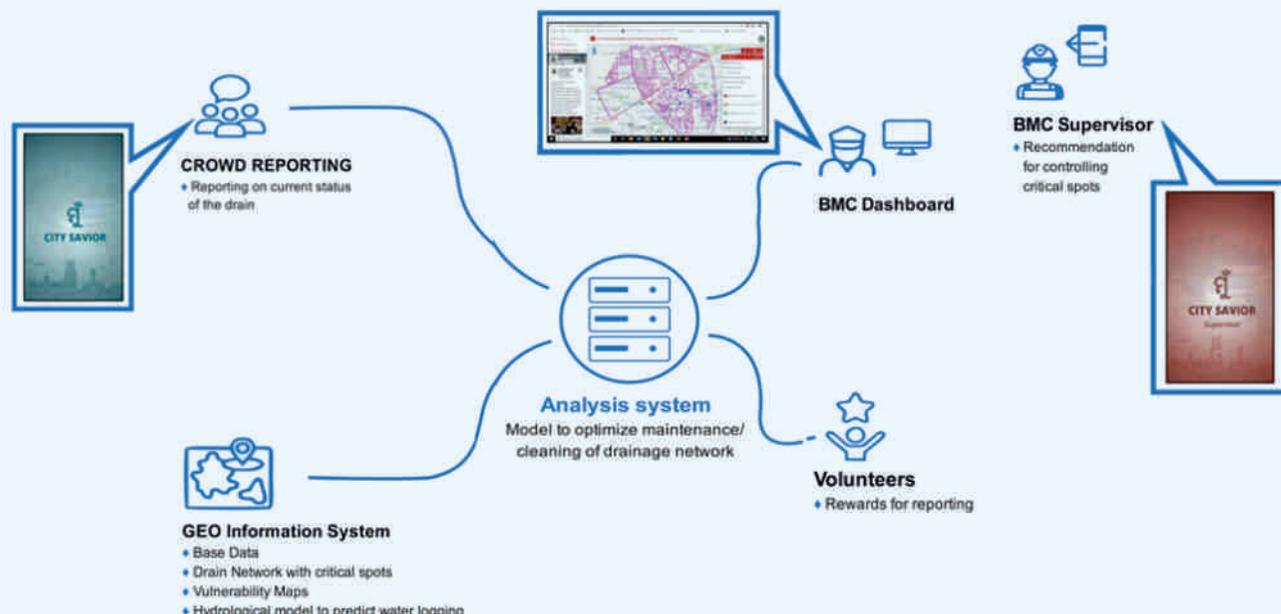


One Solution, Many Advantages

The ICT based digital solution solves many problems that an individual in the city faces during monsoon. The tool also gives assurance to the user that his complaint will be handled within the stipulated period of time by the authorities. The hybrid solution works on both Android and Apple platforms. It can be downloaded from the Play Store or Apple Store. After downloading and installing the Application and completing the registration, the users are ready to change the city for one drain block at a time.

The Mu City Savior Application is developed, keeping in mind the flooding situation in Bhubaneswar. The Application is youth oriented and user-friendly, for 15-24 year young adolescents who are tech-friendly and keen to change the city. The Application has gamified the reporting tasks, where the volunteers get points and ranking for reporting the conditions of the pre-selected spot of the drain system. The Application guides the volunteers to those locations which are pre-marked with a visual marker.

Next, with the help of a reference picture, the volunteer identifies the current status of water flow in the drain, the garbage levels in the drain and then taps the “Report” button. This information is then sent to Municipal Corporation dashboard for further analysis. For each report, the volunteers gain virtual points, which increases their ranking in the game. A large number of users for this Application can ensure significant changes in the city drainage system, making it more efficient over time. An efficient drainage system will prevent loss of life due to accidents caused by flooding, loss of working hours due to people not able to reach offices during floods, and also prevent many water borne diseases. The economic and social benefits of the Application can be studied over a long period of time and replicated to all other existing or upcoming cities. The Application will truly make the cities climate resistant in future.



11. ICT Solution Transfer To Other Cities



As an open source technology, the ICT solution is completely transferrable to other cities nationally and internationally. The solution adapts to each city's unique demands and needs and can be modified to meet those demands. Using the web based hosting services, which make the platform easily available, interested cities can easily transfer and customize the solution to their specific needs, capacities and IT requirements.

The ICT solution developed for Kochi known as Flood Free Kochi, is a fine example of how the technology that was initially developed for the cities of Trujillo and Chiclayo in Peru and for Bhubaneswar in Odisha, India, was customised for the city of Kochi, Kerala (India). This is a direct transfer of knowledge with specific modifications and adaptations for the Indian climate, people, social behaviour and sensibilities.

As an upgrade, the Application also incorporates the mechanism to report about garbage heaps around the city, enabling smooth vehicular movement, cleaner roads and surroundings, thus preventing air and water pollution and seasonal outbreak of various illnesses.



12. Flood Free Kochi: A Brief Introduction



Flood Free Kochi is a hybrid ICT based solution designed to collect data from Kochi city as water logging is a common occurrence in the rainy season. The solution has a gaming interface that makes it interesting for the willing citizen volunteers to use the Application. The citizen volunteers can report about water logging, water levels in the drains, man-made or natural road-blocks or drain-blocks, overflowing drains for authorities to take action on. All this is done via an un-interrupted network system at Kochi Central Command Centre. The data collected over a period of time is studied and helps in improving the city drainage system, as well as garbage disposal system.

The Flood Free Kochi solution too has the same end-to-end components like the solutions developed for other cities, which have been mentioned in the document previously.

The components are as follows:

1. **Crowd Reporting Application:** For citizen volunteers to download the Application on their phone and use it to report the water logging issue.
2. **Geographic Information System:** GIS provides detailed information about the topography of the area including, land use, population and hydrological network.
3. **Analysis System (Ranking Model):** The Analysis System is the core of the entire solution. It uses an algorithm to analyse the input data from the crowd reporting Application and the GIS data to create a ranking of the critical spots to be cleaned on priority. This is then displayed at Kochi Municipal Corporation Dashboard at the command centre.
4. **Display Dashboard:** The Display Dashboard displays the recommendations based on the Analysis System to the officials. Each critical spot is shown with a cleaning priority that helps the authorities to priorities their resources.
5. **Supervisory Application:** The Supervisory Application is closely linked to the Display Dashboard. It helps the supervisors to control the cleaning of the ranked spots as per the ranking. The overall feedback from the supervisors then can be submitted back in the system.

Key Stakeholders

Following key stakeholders were selected for the process of developing flood free Kochi Application:

- | | |
|-------------------------------|---|
| 1. Kochi Smart City Officials | 4. Kochi Fire Services |
| 2. Citizen Patrons | 5. Kochi Government Officials |
| 3. Drain Cleaning Agency | 6. Indian Meteorological Department Officials |

Process Of Development

The process of development for the solution went through the same stages that of Bhubaneswar with important upgrades, keeping in mind the local challenges and sensibilities.

1. Identifying the most urgent challenges that the city faced
2. Ideating and co-creating the digital solution with the stakeholders to tackle the challenges
3. Implementing by testing and rolling out the designed solution in selected pilot areas
4. Scaling up with feedback to cover the entire city



Conclusion

The **Flood Free Kochi** Solution comes after ICT based solutions for three pilot cities had already been developed and implemented. These cities are Trujillo and Chiclayo in Peru and Bhubaneswar in India. The aim of the project is to support local municipalities and local governments in achieving sustainable climate resistant cities, while achieving Sustainable Developmental Goals.

The project's innovative approach to data collection, analysis and dissemination will enable public administration and decision makers to integrate climate change adaptation measures into their urban development plan.

Developing citizen partnerships by actively engaging them in the development process, addressing local climate challenges, contributing to the existing and new urban planning processes by way of extensive and continuous collection of data are some of the strategic principles of the ICT based solution that offers a wide variety of benefits like optimum resource utilisation, emergency city management during flood times, streamlining work of the massive workforce in maintaining the cleaning of the city and strategic level benefits by providing extensive data bank over a period of time.

13. The Team



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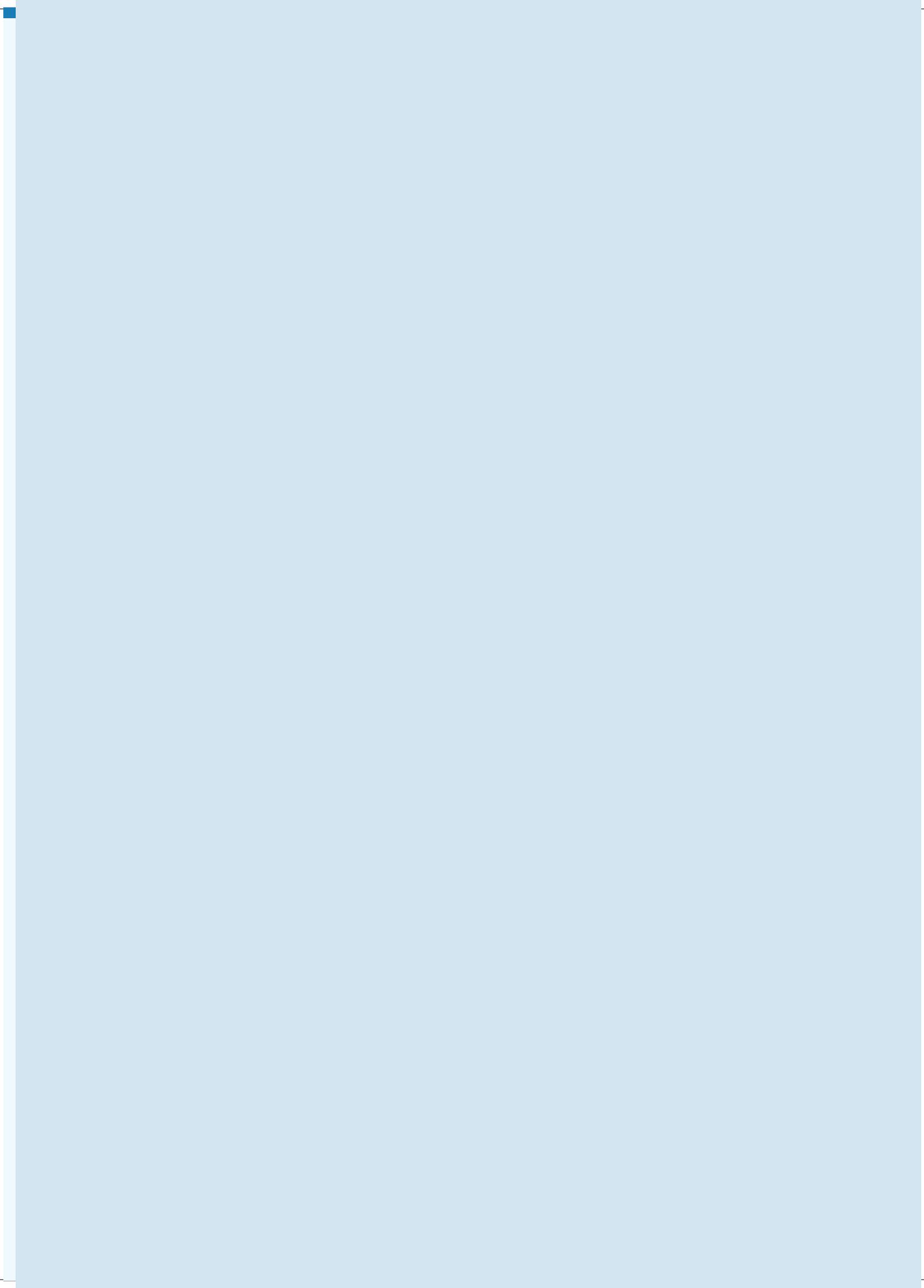
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