ICT solutions/ Soluciones ICT

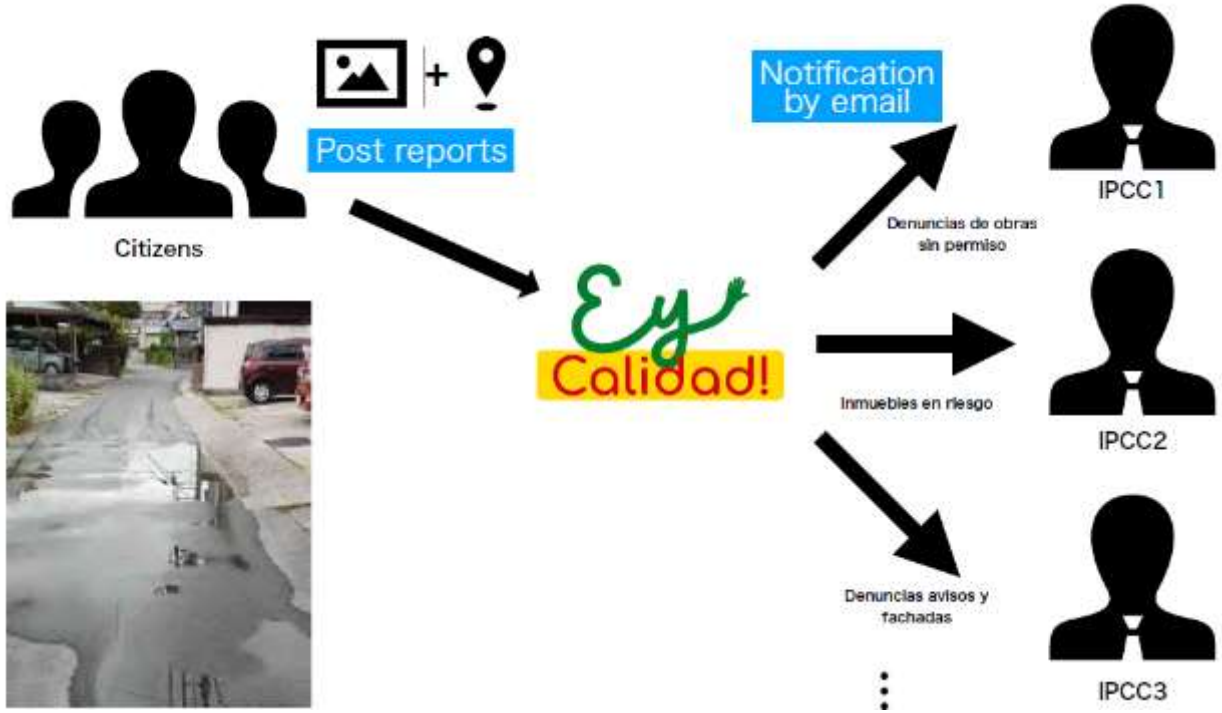
✓ **Citizen participation:**
EyCalidad by Dappi Studio

✓ **Heritage protection :**
Monitoring Heritage Systems (MHS) by Santa Maria Foundation

Solution 1: EyCalidad

- EyCalidad provides a function for citizens to participate in creating a better city in collaboration with the government.

What /Where is the city issue?
Who/how to well manage and respond?



Solution 1: EyCalidad

- There are 4 status in the reporting process.

	1. Report by Citizen	2. Confirm by IPCC	3. Contact to Architect	4. Response by IPCC
User	Citizens	IPCC	IPCC Architect	IPCC
Status	PUBLICADO	REVISADO	EN GESTIÓN	ATENDIDO
	A citizen publishes report/ El usuario hace su publicación	Report is checked/ La publicación ha sido vista por el profesional al cargo	Architect's visit is scheduled/ Se ha hecho la primera publicación de la respuesta: se programará visita	Scheduled action is notified to the citizen/ La acción programada se notifica al ciudadano

Solution 1: EyCalidad

Pilot result / Resultado piloto

PoC walk around

- We walked around the city with IPCC and OAI members. (14 February)
- We examined which problems should be posted on each categories.

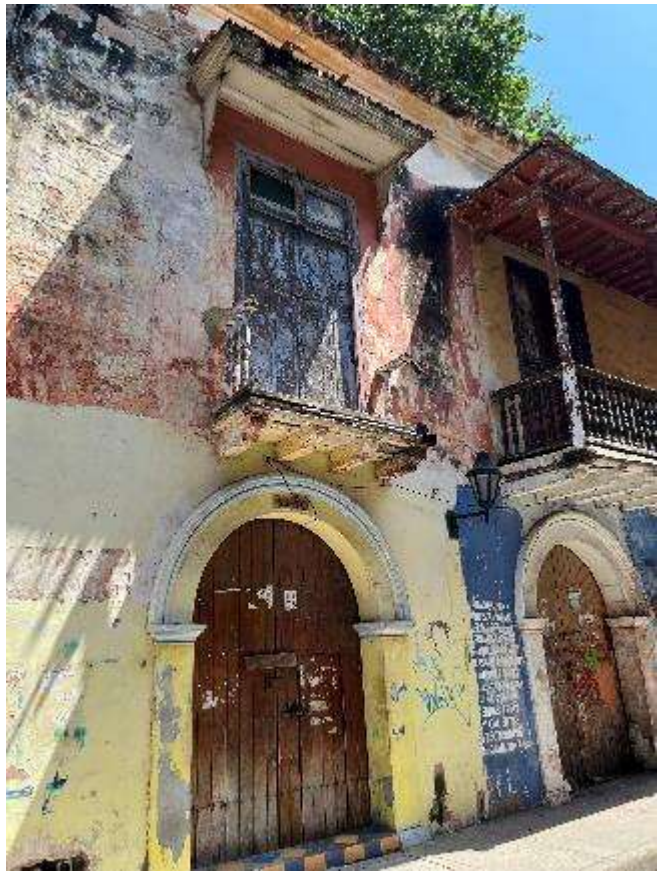
Categories	
Complaints of construction work without a permit	Denuncias de obras sin permiso
Properties at risk	Inmuebles en riesgo
Complaints about signs and facades	Denuncias avisos y fachadas
Others	Otros

PoC walk around

- Complaints of construction work without a permit (“Denuncias de obras sin permiso”) category
- As a citizen, it’s difficult to know which building is historical one and whether it’s legal or illegal construction.
- Some issue (For example, position of outdoor units of air conditioners) can be posted by citizen. (Must not be placed on the street side.)

PoC walk around

- Properties at risk (“Inmuebles en riesgo”) category
- Issues in this category are easy to be found by citizens
- Balcony is decaying. (There was an accident at another building)



PoC walk around

- Complaints about signs and facades (“Denuncias avisos y fachadas”) category.
- These are easily found by citizen if regulations are presented.
- Ex) Material and size for signboards for shop’s facade.
- Ex) Number of advertisements on facade.

PoC data (“Others” category)

Sidewalk

Graffiti

Plants

Garbage

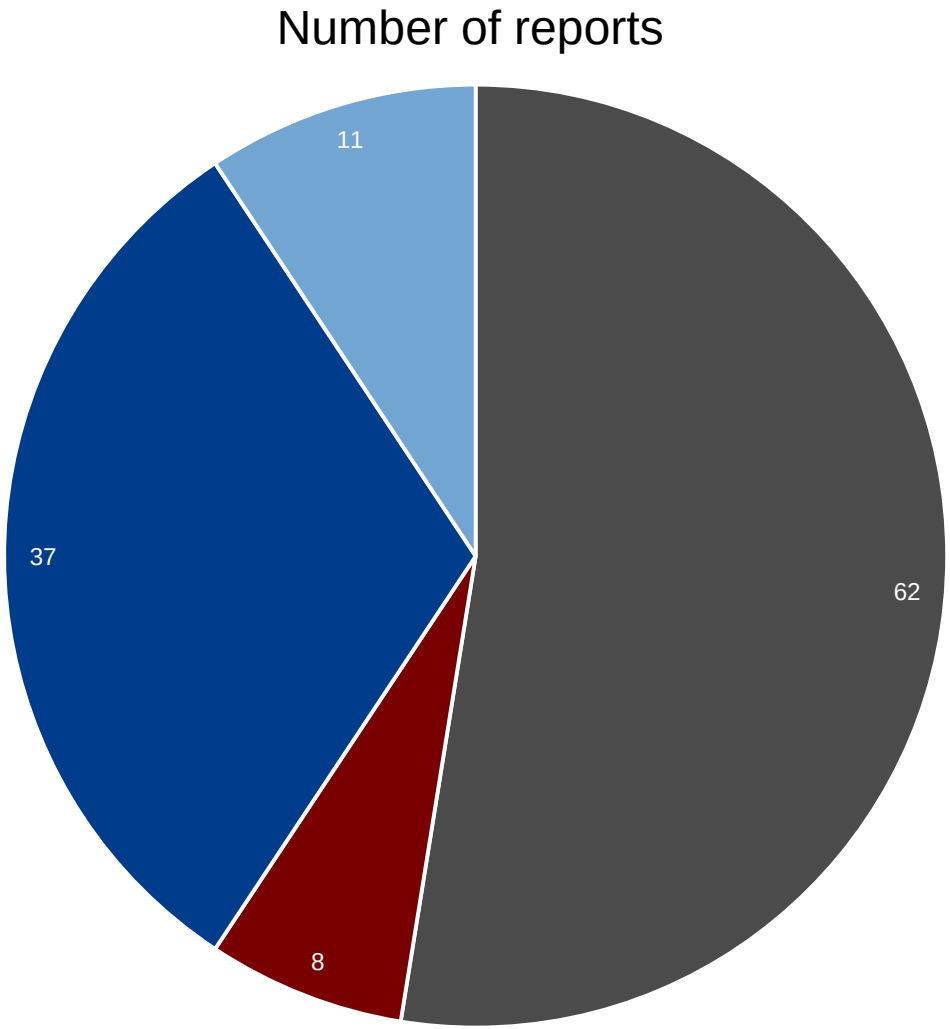
Posted reports in PoC

118 reports by 30 users

See reports on website >
https://col.pausted.com/cities/00001

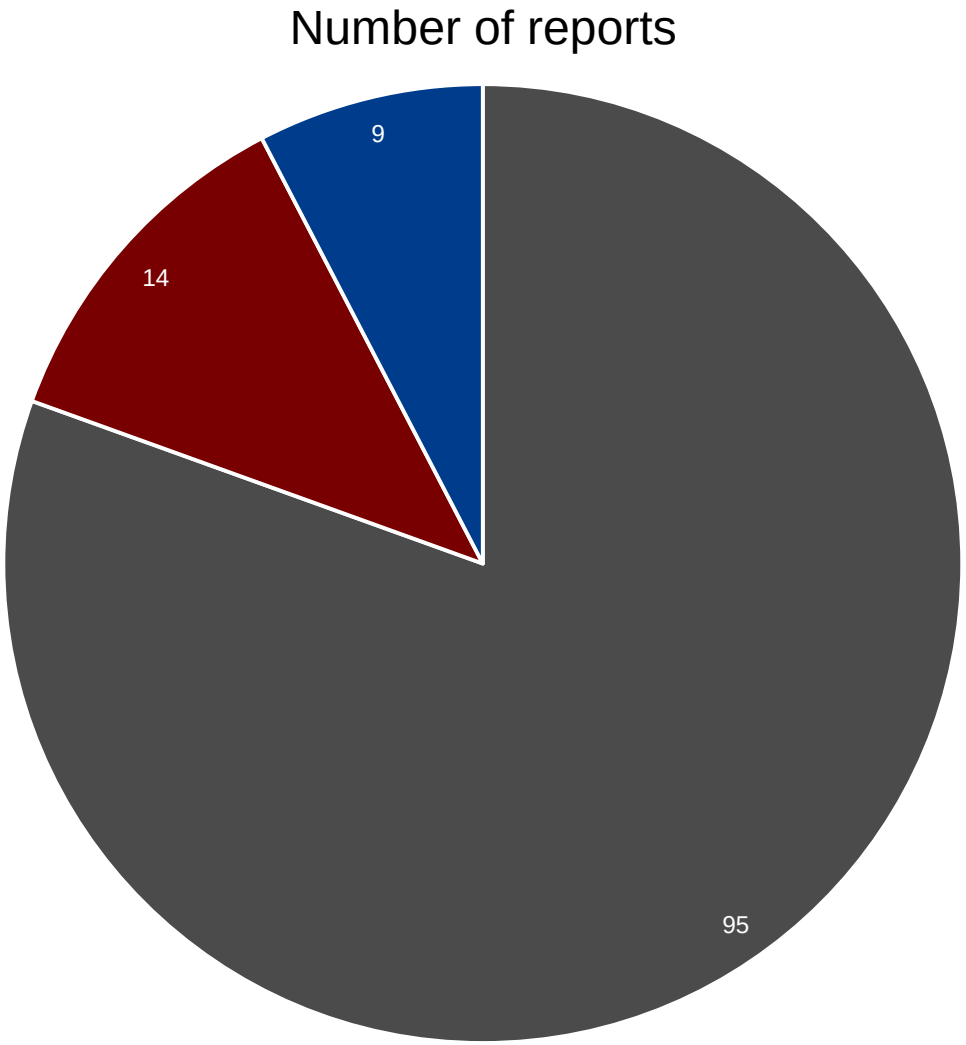
PoC data (by categories)

Properties at risk	52.5%
Complaints of construction work without a permit	6.8%
Complaints about signs and facades	31.4%
Others	9.3%



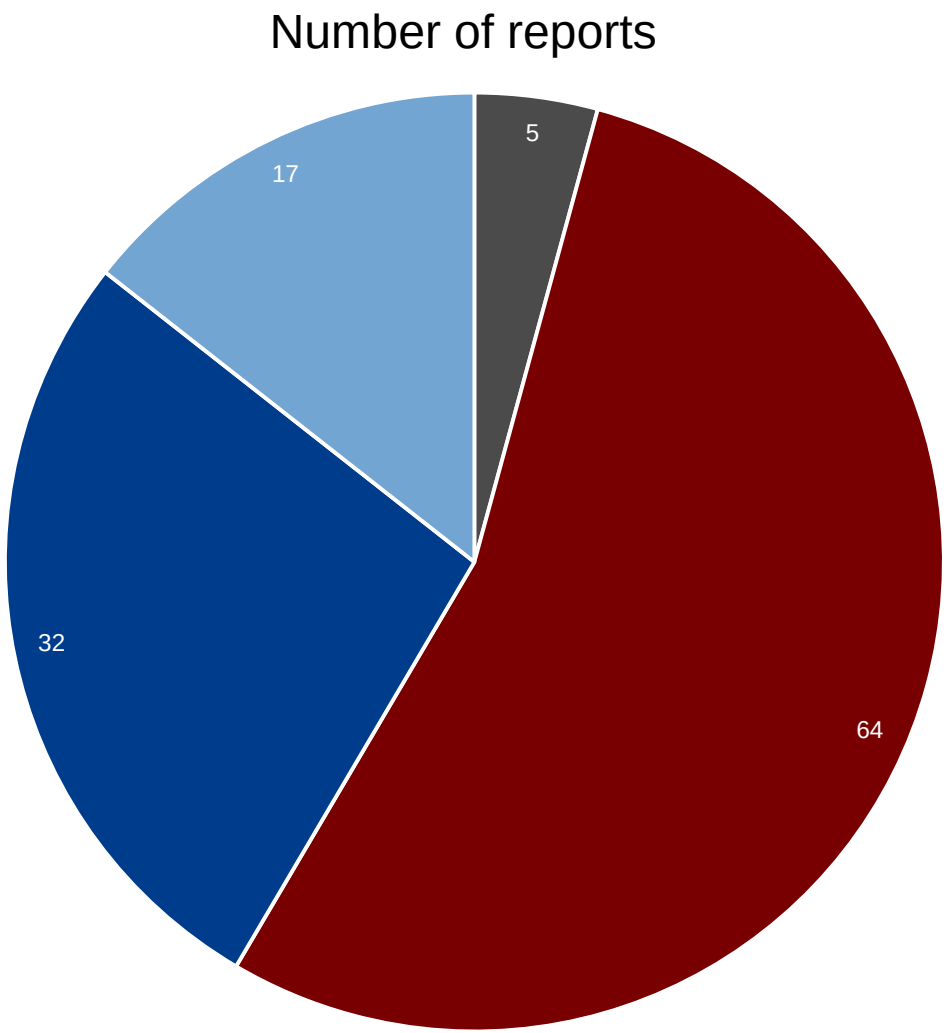
PoC data (by posted hours)

Office hours	80.5%
Out of office hours:	11.9%
Saturdays and Sundays	7.6%



PoC data (by status)

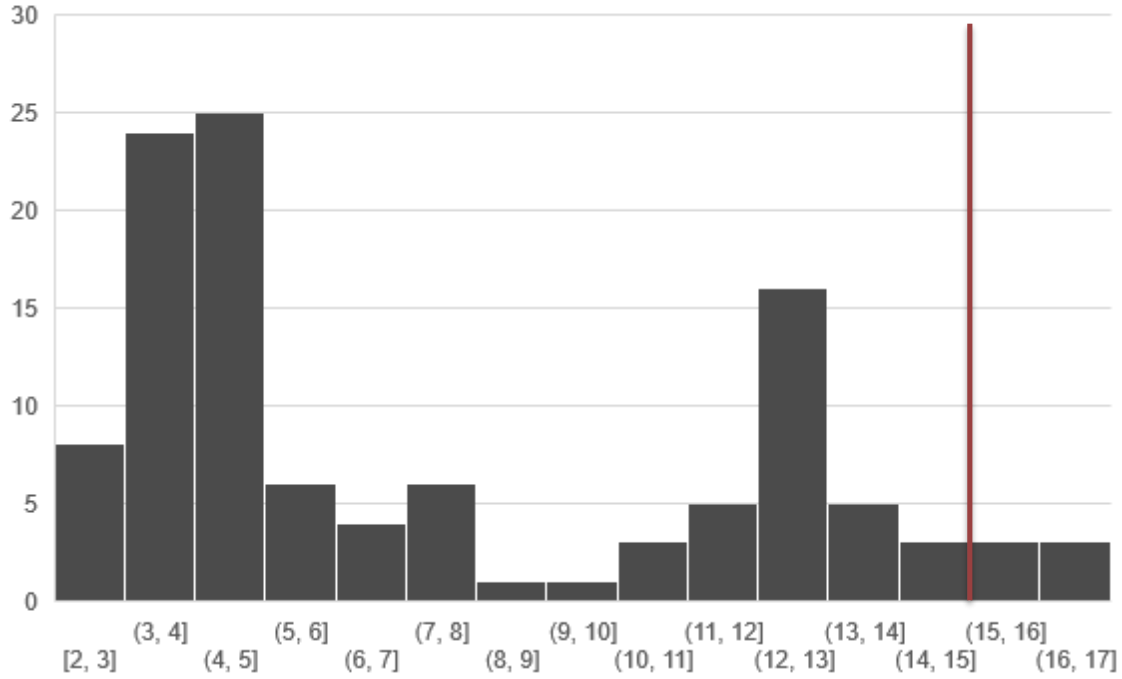
PUBLICADO (POSTED)	The user makes his/her report.	4.2%
REVISADO (REVISED)	The report has been seen by the professional in charge.	54.2%
EN GESTIÓN (IN MANAGEMENT)	First response has been made: visit will be scheduled.	27.1%
ATENDIDO (ATENDED)	A substantive response has been given to the complaint and the actions to be taken are communicated.	14.1%



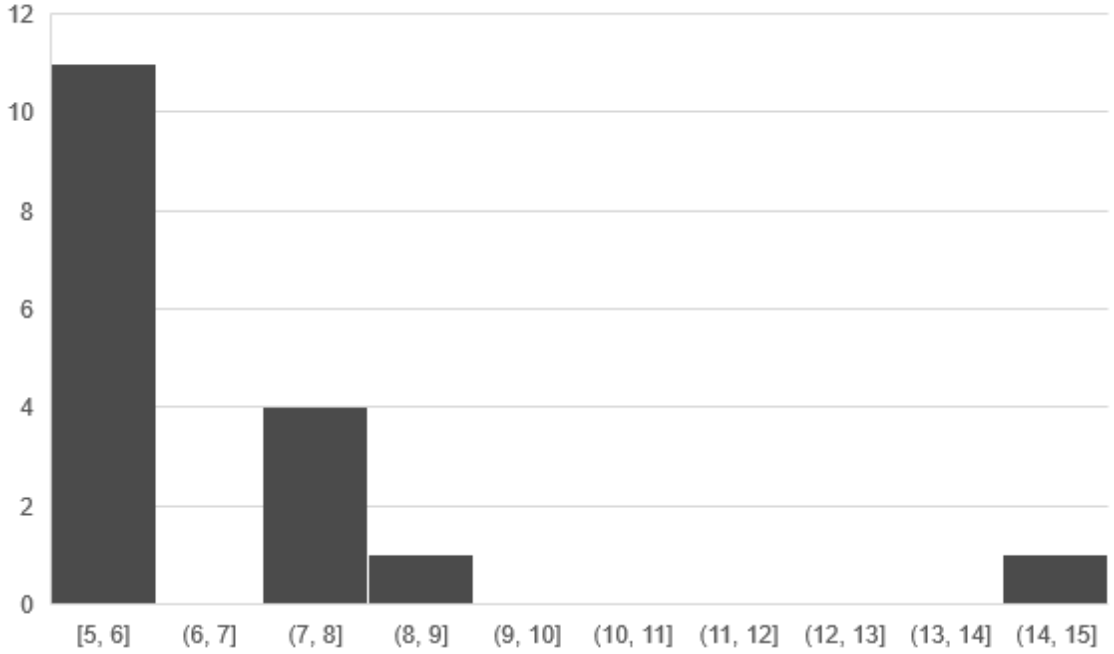
PoC data (days took to respond)

- First response within 15 working days: 94.7%

Working days to first response



Working days to complete (=attended)



Effectiveness Verification

- A questionnaire, and qualitative interviews were conducted with citizens and government administrators to assess 1) usability, 2) citizen participation and 3) administration operation.

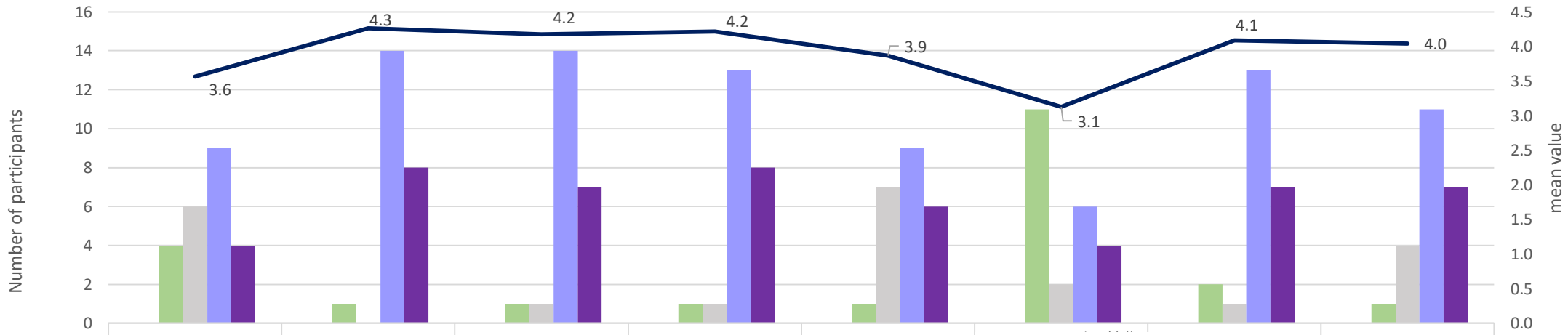
Objective.	User survey for the application
interviewees	City Hall employees who participated as citizens • OAI (20 employees) • IPCC (3 employees)
evaluation period	March 6-10
method of investigation	Distribute survey forms Questionnaire Items • Functionality and usability evaluation (5-point scale) • Needs for additional functions, improvements, etc. (free description) • Other uses (free description)

Objetivo.	Encuesta a los usuarios de la aplicación
entrevistados	Empleados del Ayuntamiento que participaron como ciudadanos • OAI (20 empleados) • IPCC (3 empleados)
período de evaluación	Del 6 al 10 de marzo
método de investigación	Distribuir formularios de encuesta Cuestionarios • Evaluación de la funcionalidad y usabilidad (escala de 5 puntos) • Necesidades de funciones adicionales, mejoras, etc. (descripción libre) • Otros usos (descripción libre)

(1) Usability

- Overall, the application was highly convenient and received high marks for functions such as user registration, posting, and status checks.
- Technical support and training were found to be necessary for use.

Results of a survey of citizens



	Is the design good enough?	Is it easy to register and log in?	Is it easy to post?	Is it easy to track status?	Is the functionality integrated?	Can you use it without training or technical support?	Overall usefulness?	Would you recommend it to others?
I don't think so at all.	0	0	0	0	0	0	0	0
I don't think so.	4	1	1	1	1	11	2	1
Neither.	6	0	1	1	7	2	1	4
I think so.	9	14	14	13	9	6	13	11
I agree very much.	4	8	7	8	6	4	7	7
mean value	3.6	4.3	4.2	4.2	3.9	3.1	4.1	4.0

I don't think so at all. | I don't think so. | Neither. | I think so. | I agree very much. | mean value

5-point scale 1 2 3 4 5

(1) Usability

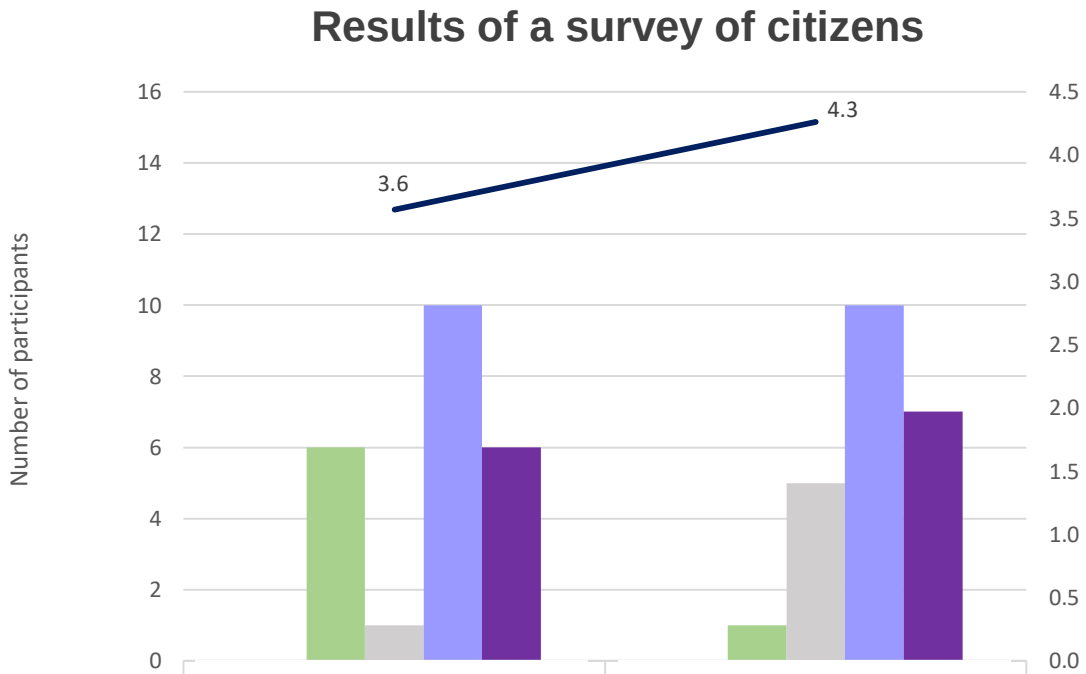
- There are needs related to a function that would allow citizens to report more fields and types of information directly to the government.
- Some citizens expressed a positive desire to add their own categories to the system, as only a limited number of categories were covered in this survey.

Improvements and additional features you would like to see	• Ability to add your own categories as needed • Ability to search filters on your own postings. • Ability to report system malfunctions • Help function to check operation methods, etc.
Categories needed in the future	• Categories needed for other departments within City Hall. • Categories of all assignments required in the city • Categories related to public facilities and public transportation issues
Other utilization suggestions	• Communication with other departments within City Hall • Information exchange tool for police officers • Waste Management • Traffic situation management • Collaboration with government and partnering vendors

Mejoras y funciones adicionales que le gustaría ver	• Posibilidad de añadir sus propias categorías según sus necesidades • Posibilidad de utilizar filtros de búsqueda en sus propias publicaciones. • Capacidad para notificar fallos del sistema • Función de ayuda para comprobar los métodos de funcionamiento, etc.
Categorías necesarias en el futuro	• Categorías necesarias para otros departamentos del Ayuntamiento. • Categorías de todas las asignaciones requeridas en la ciudad • Categorías relacionadas con instalaciones públicas y transporte público
Otras sugerencias de utilización	• Comunicación con otros departamentos del Ayuntamiento • Herramienta de intercambio de información para policías • Gestión de residuos • Gestión de la situación del tráfico • Colaboración con la Administración y los proveedores asociados

(2) Citizen participation

- Participants evaluated the use of the app as a way to improve communication with the government and to work with the government to create a better city.



	Would it support communication with the government?	Will it contribute to a better city with the government?
I don't think so at all.	0	0
I don't think so.	6	1
Neither.	1	5
I think so.	10	10
I agree very much.	6	7
mean value	3.6	4.3

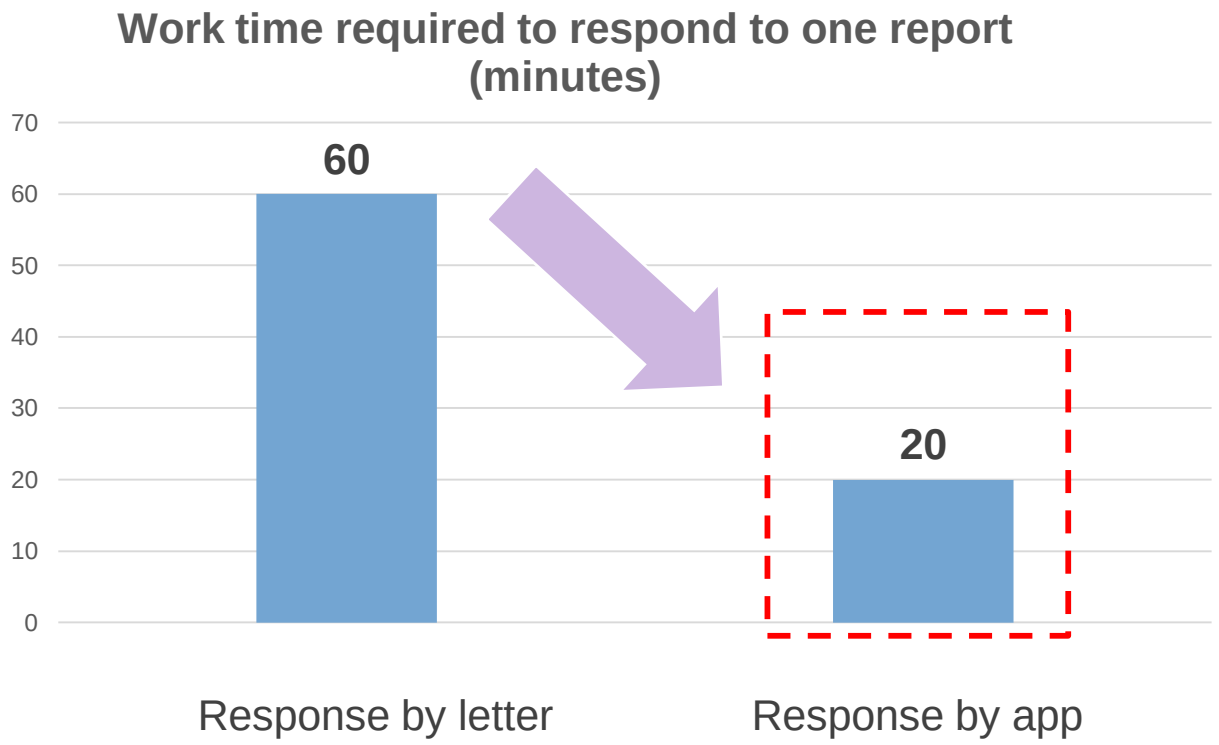
(2) Citizen participation

- It is observed that communication between citizens and city hall occurred 231 times. This implies Eycalidad plays a role in supporting close communication between citizens and government.

	PUBLICADO	REVISADO	EN GESTI MON N	ATENDIDO	
status	Submitted by citizen	Submissions are verified by the administration. Notify citizens that action is being taken	Coordinate site visits Notify citizens of coordination details	Communicate response methods and plans to the public after the visit.	
process	**citizen** → Eycalidad → **city hall** An email is sent to the City Hall staff when you make a submission .	When City Hall adds a comment or changes the status of a citizen's submission, an email is sent to the submitting citizen.	same as left	same as left	
					Total
Interactions	**118**	**64**	**32**	**17**	**231**

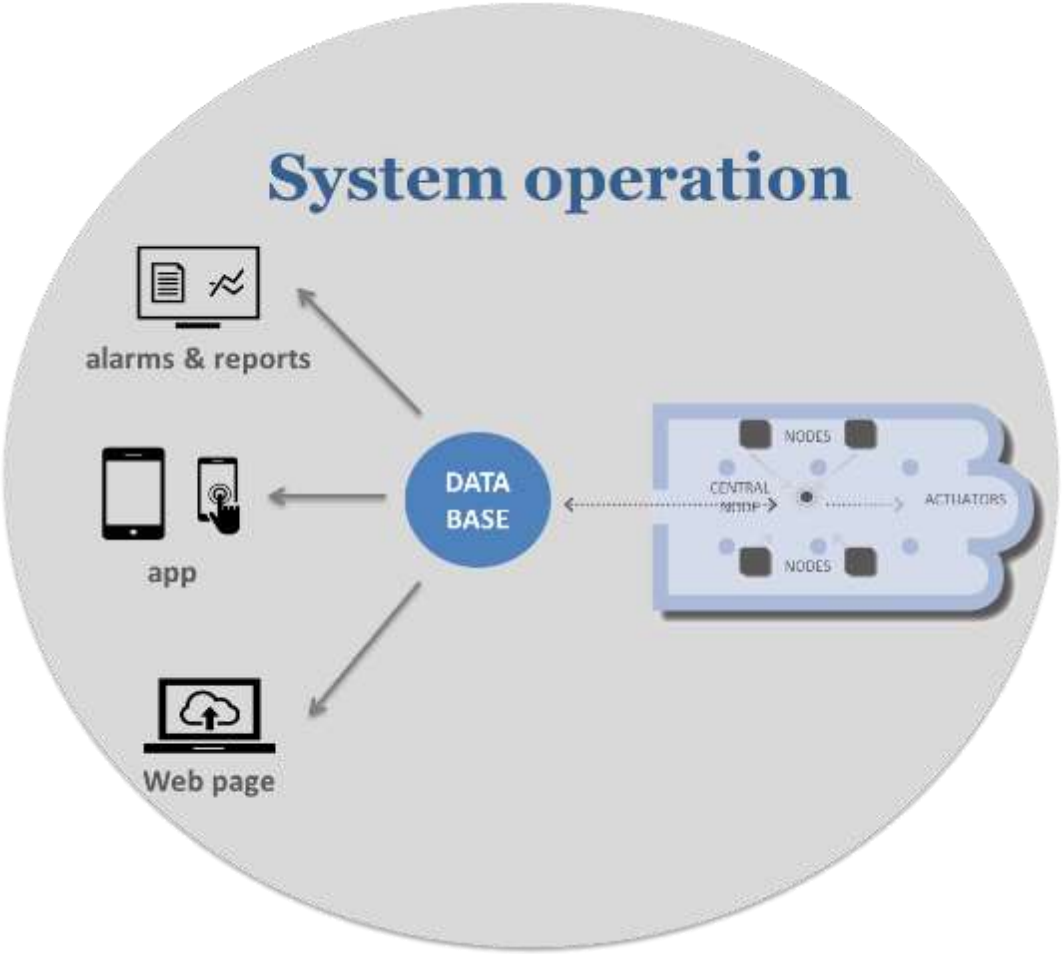
(3) Improved administrative operations

- As a result of interviews with city hall employees, preparing a formal response to one report by letter could take 1 hour, but the response by Eycalidad could be done in 20 minutes. It suggests that using app could reduce the time required for one response to 1/3 and increase efficiency in administrative work.



Solution 2: MHS

- Monitoring Heritage System (MHS) collects and analyzes data on heritage sites from sensors to prevent risks and damage.



- Temperature, humidity, illumination, solar radiation, and any other parameters are measured by sensors

Solution 2: MHS

MHS Monitoring Heritage System

- In consultation with the City of Cartagena, the Adolfo Mejia Theatre was selected as the target site.

Adolfo Mejia Theater
- Protective work is needed for the building and objects inside the building.

Solution 2: MHS

MHS Monitoring Heritage System

Pilot result / Resultado piloto

Actual implementation of the solution

- The installation in the Adolfo Mejía Theater is composed by;
- Environmental nodes (temperature, relative humidity, and degree of humidity) would be installed in 4 spaces, and 4 more contact nodes (temperature, relative humidity, degree of humidity, and luminosity) would be installed in particularly sensitive objects and arts.
- In the structural section, 2 fisurometers will study the cracks in the walls.
- Some coordinators nodes amplify the network to ensure the correct communication of the information generated by the sensor skin to the central node that gather all the data generated and also send it to the BD.
- Finally, a visualization with all the information collected by the sensors will be generated in a dashboard.

Actual implementation of the solution

- **CENTRAL NODE**

- It is the communication node inside the building, as well as with the outside via the internet, it is connected to the electrical network.
- This node will capture all the information generated from all the installed nodes.
- It will also store the information in its storage system.
- Also, thanks to its internet connection, it will send the data series to a cloud service that will generate the status indicators.
- It is located on the access floor in a central box.

Actual implementation of the solution

- **COORDINATOR NODE 1**

- It is an intermediate communication node between the sensor nodes and the central node, it is connected to the electrical network.
- Its function is to forward the information received from environmental or contact nodes to the central node.
- It is located in the south corridor that gives access to the boxes on the access floor.

Actual implementation of the solution

- **COORDINATOR NODE 2**

- It is an intermediate communication node between the sensor nodes and the central node, it is connected to the electrical network.
- Its function is to forward the information received from environmental or contact nodes to the central node.
- It is located on the stair that gives access to the third floor.

Actual implementation of the solution

- **COORDINATOR NODE 3**

- It is an intermediate communication node between the sensor nodes and the central node, it is connected to the electrical network.
- Its function is to forward the information received from environmental or contact nodes to the central node.
- It is located in the baths of the backstage in the third floor.

Actual implementation of the solution

- **ENVIRONMENTAL NODE 1**

- An environmental node that measures the parameters of temperature, relative humidity, and humidity.
- It is powered by a battery.
- It is located in the main entrance hall of the theater, on the cornice of the south pillar of the triumphal arch.

Actual implementation of the solution

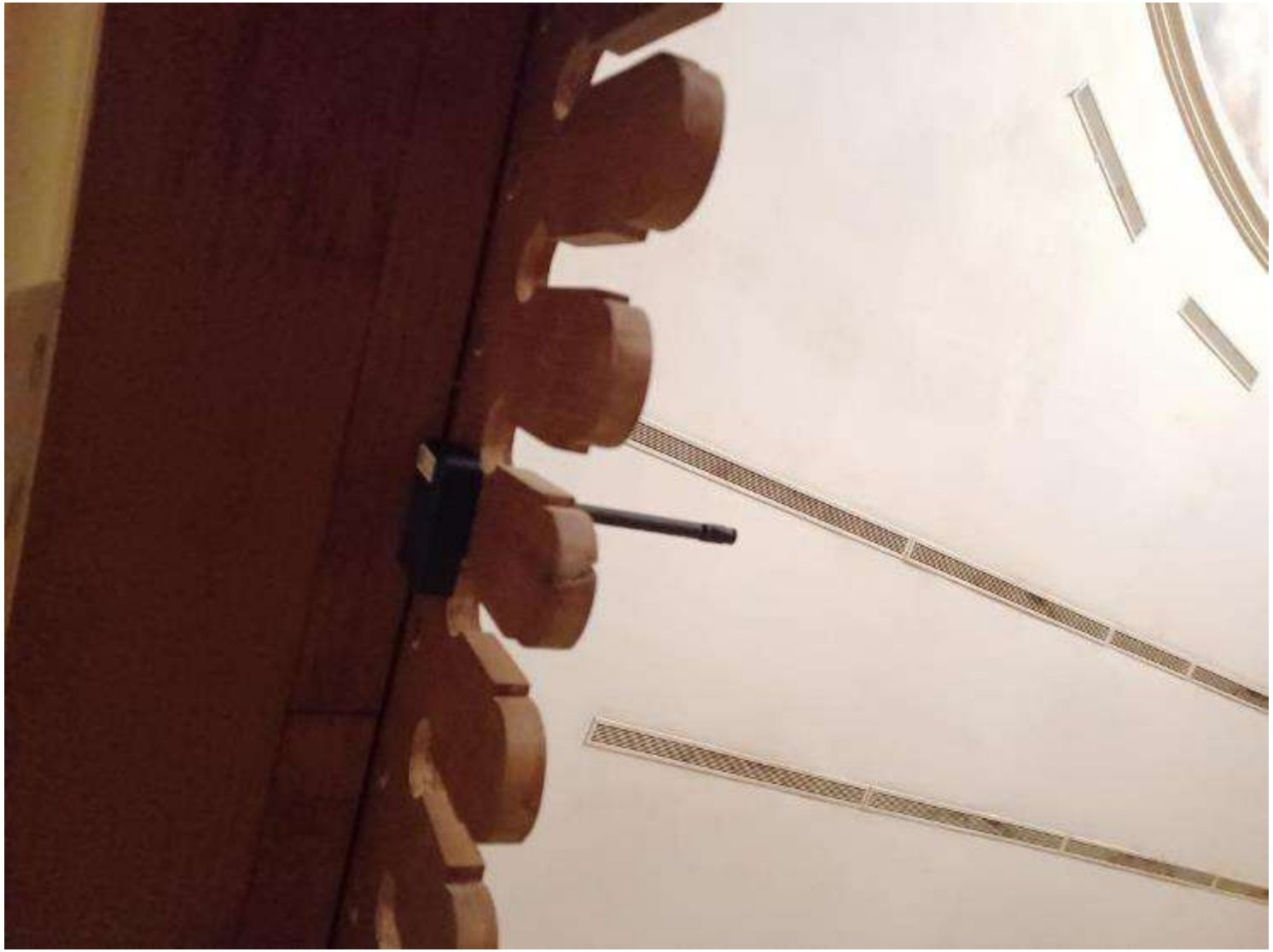
- **ENVIRONMENTAL NODE 2**

- An environmental node that measures the parameters of temperature, relative humidity, and humidity.
- It is powered by a battery.
- It is located on a pillar of the north boxes of the access floor.

Actual implementation of the solution

- **ENVIRONMENTAL NODE 3**

- An environmental node that measures the parameters of temperature, relative humidity, and humidity.
- It is powered by a battery.
- It is located in a decorative element of the north boxes on the second floor.



Actual implementation of the solution

- **ENVIRONMENTAL NODE 4**

- An environmental node that measures the parameters of temperature, relative humidity, and humidity.
- It is powered by a battery.
- It is located on the false ceiling under the roof.

Actual implementation of the solution

- **CONTACT NODE 5**

- A contact node that measures the parameters of temperature, relative humidity, humidity, and luminosity.
- It is powered by a battery.
- It is located under the north painting of the stage.

Actual implementation of the solution

- **CONTACT NODE 6**

- A contact node that measures the parameters of temperature, relative humidity, humidity, and luminosity.
- It is powered by a battery.
- It is located on the ceiling of the third floor, next to the central mural paintings of the stalls.

Actual implementation of the solution

- **CONTACT NODE 7**

- A contact node that measures the parameters of temperature, relative humidity, humidity, and luminosity.
- It is powered by a battery.
- It is located in the border decoration of the south wall of the foyer.

Actual implementation of the solution

- **CONTACT NODE 8**

- A contact node that measures the parameters of temperature, relative humidity, humidity, and luminosity.
- It is powered by a battery.
- It is located on the curtain.

Actual implementation of the solution

- **STRUCTURAL NODE 9**

- A structural node that measures movements in cracks.
- It is powered by a mains connection.
- It is located in one of the pillars in the hall.

Actual implementation of the solution

- **STRUCTURAL NODE 10**

- A structural node that measures movements in cracks.
- It is powered by a mains connection.
- It is located in the dressing room bathrooms.

Actual implementation of the solution

- **PANEL CONTROL**

- The panel has been located in the IPCC premises, specifically in the office of the director of heritage.
- The purpose of the control panel is to visualize the data in real-time, in addition to displaying the raw data (value recorded by the sensor) each data is displayed inside a colored box (green - good, yellow – anomalous, orange - at risk) showing the conservation status of the data, the node, and the building as a whole.

Heritage preventive conservation

- Let’s test it!
- https://www.mhsproject.com/app/

Conclusions & results

GENERAL STATE OF CONSERVATION OF THE BUILDING

- The general condition of the building recorded during the PoC can be considered as a building with conservation risks. The building and its assets require monitoring for this state of risk, furthermore, actions in the ventilation system in the building are considered highly recommended and if measures are not taken in the medium term the building may have compromised its safety and use.

- Regarding the telecommunications infrastructure present in the theater, it provides a wifi network for internet access with certain periods of lack of signal that makes it impossible to send data continuously, MHS has recovered data remotely on several occasions when there has been an interruption in the internet connection. In addition, there have been power outages for several consecutive days, in which case it has not been possible to recover the data. Corrective actions need to be taken with regard to the internet connection, wifi, and electrical system.

Conclusions & results

CONCLUSIONS AMBIENTAL

- The environmental conditions of the building, assets, and rooms studied indicate that the building has erratic ventilation that shows a conservation condition with risks due to high humidity and high temperature. The ventilation pattern is carried out when there is personnel in the building, which means that ventilation is not carried out during the hours with the best external weather conditions. To this point we must also add that the events that take place in the theater bring a notorious change in the interior conditions, lowering the relative humidity by around 30% and the temperature by 5ºC because de AC is on, these changes in short periods of time represent a thermal and humidity shock to the building and the goods.

- In terms of luminosity, the theater lighting is adequate and does not pose a risk on a regular basis; the only point with risk is in the foyer, which indicates that it is not advisable to install paintings or pictorial works that could be damaged by the lighting.

- Finally, it should be noted that it is necessary to continue collecting data and wait for a period of 12 months to confirm these assumptions.

Conclusions & results

CONCLUSIONS STRUCTURE

- The fissure in the hall, has remained constant and has not had any movement, so it can be said that in this month it is not considered a risk for the building.

- The crack in the dressing rooms and the northwest facade has had a minimum movement of 0.1 mm during the study period. In this case, although the movement has been recorded, it is not significant and may be irrelevant, but as with the crack in the hall, it is necessary to be cautious and wait to confirm these assumptions.

- Finally, it should be noted that in both situations it is necessary to continue collecting data and wait for a period of 12 months to confirm these assumptions, so the structural conclusions cannot be considered conclusive.

Conclusions & results

ACTIONS TO BE TAKEN

- The first and most urgent recommendation is to maintain monitoring to determine whether the conclusions gathered during the PoC are conclusive.

- Secondly, it is recommended that analyses be carried out at least every six months to study the evolution of environmental and structural conditions.

- Thirdly, an action to be taken would be to improve the ventilation of the theater, which is currently done by opening doors without a clear criterion that helps conservation, both an implementation of guidelines and a forced ventilation system without air conditioning are two actions to be studied immediately.

- Last but not least, it is strongly recommended to check and implement corrective actions for power outages, these have durations of days and are a problem for all electrical equipment, also the internet connection also has room for improvement due to poor Wi-Fi coverage.

Conclusions & results

PROPOSALS and RECOMMENDATIONS

- The improvements that are considered plausible for the system in the future are presented in three main groups;
  - First, it is proposed to install electrical measurement sensors in the air conditioning equipment to improve its system operation, and performance.
  - Secondly, it is recommended to implement a system to measure the number of people and accesses, which will allow studying the impact of people on the building and its assets, as well as the energy sustainability of the building in relation to the number of users.
  - Thirdly, in future actions, it is advisable to adopt monitoring systems in other buildings in a similar way, which is why continuing to work in the field of smart cities ensures that this facility is integrated into a broader system that will facilitate the management of visitors, tourists, and citizens to the public administration with a holistic view of the needs and real demand of Cartagena.

Effectiveness verification

- The interview was conducted with IPCC member.
- The usability of the MHS was evaluated high, as it is convenient and easy to use.
- The visual display also helps users to quickly capture the risk of the heritage.

point of view	indicator	Result
usability	• Interface usability, ease of operation, etc.	• Logging into and operating the system was easy • The design and structure of the system was evaluated as easy to understand.
	• Ease of handling information and data on the system	• The data collected in real time is displayed using a plan view and a 3D survey, which can be determined by color differences, and was evaluated for its ability to quickly visualize the preservation status of the entire building and detect risks.

Effectiveness verification

- In terms of administrative operations, it is observed that MHS helps them to make decisions on better protection measurements for the important cultural heritage.
- IPCC, however, suggests that the long term data collection is necessary to assess the effective maintenance plan and cost-benefit of the system.

point of view	indicator	Result
Improving administrative operations	• Improved risk management for damage to cultural heritage	• Understanding the site and its environmental conditions would allow decisions to be made on air conditioning adjustments (turning air conditioning on and off, opening windows and doors, etc.), which would help protect the theater's art collection and cultural heritage. • No risk alerts were generated during the demonstration period due to insufficient data. More long-term measurements are needed.
	• Reduce the cost of maintaining and managing cultural heritage	• It was not possible to provide specific cost reduction values based on this demonstration alone. • It is expected that the structural recording and management of cultural heritage issues by the MHS will lead to overall cost reductions in the future because it will focus only on necessary surveys and lead to more effective maintenance activities.