**Change Request Analysis Internal Document**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| Title | Change Request Analysis Internal Document |
| Version | 4.0 |
| Author | José Raúl Castañeda Rosas |
| Date | 23/03/2023 |
| Comments | This is change report for SMMA with policy and swot. |

**INTRODUCCIÓN**

This document is a tool to describe the changes requested to the SMMA monitoring platform by the main customer. The monitoring system has several IoT nodes whose function is to obtain information from the environment and upload it to the DB. Having a large number of IoT nodes that perform a large number of data insertions to the only DB, concern has been generated that the system can hardly be scaled to monitor a large number of geographical areas. The main interested parties have expressed their concern that the traditional database model is not sufficient to be able to handle all the requests from the different IoT nodes, which could generate a drop in service, which is why on-demand customers the system to switch to the distributed database model in order to divide the load among several nodes. On the other hand, some clients have asked us to create a section in the system to register sensors specifically in the system, thus avoiding registering each sensor every time a new Iotnode is registered.

Clients have stated that due to a new reform in Mexico, it is necessary to send weekly statistical reports to government institutions in order to study the evolution of pollutants and harmful elements, for which reason the already existing reporting module must be restructured and a way found. to store them or create a technique to be able to create them without storing them directly.

As a change in terms of compatibility, we have been asked for the system to be compatible with most commercial browsers such as Chronium, Edge, Firefox and Oper.

Throughout this document we will approach the change request from several important perspectives for the development of the system, broadly analyzing the implications of the change.

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**CHANGE ACCEPTANCE POLICIES**

**Policy Purpose**

• Base line infrastructure change management to allow staff members and clients to plan changes together

• Reduced impact on the project or tasks

• Promote communication based on changes

• Make the infrastructure change publicly known.

• Minimize the probability of risks or errors.

**Rules and Policies to consider a change**

**1.** Only the head of a department can submit a change request

**2.** To consider a change, it must be correctly written

**a**. In case it is not well written, the owner of the change will be notified to write the document properly

**3.** Any change sent by the mechatronics or software department must be evaluated by the finance department.

**4.** All proposed changes from the mechatronics or software department that have a probability greater than 50% of presenting severe or continuous failures will be discarded.

**5.** Any change that presents a delay equal to or greater than 6 weeks will be discarded

**a.** This rule is excluded in case this change is to fix a bug

**b.** In turn, it will also be excluded if it is necessary to comply with a new governmental or environmental requirement.

**6.** Any change that implies increasing the cost of the project above 30% will be discarded.

**a.** At the same time, any change that increases the cost of the project by 60% more than the original price of the module will also be discarded.

**b.** In the case of a mandatory module, it must be evaluated on the finance side and evaluate its impact.

**7.** Changes by the internal components of the IoT node will not require the vote of the relations department to be carried out.

**8.** A change will be accepted if 70% of the participants are in favor of the change.

**a**. In changes related to the use of new components or the development of new features, the departments with the greatest weight in the vote will be the software, mechatronics and finance departments.

**9.** Change requests to add new features will not be accepted with 4 months or less to deliver the product

**10.** Changes that take more than 3 weeks will not be accepted in critical path tasks

**Process for Submitting a Change Request**

To propose a change, it is necessary to prepare a formal document which contains a detailed description of the change and the reason for which the change is desired. The document will be sent through the changes module. The change should not be contemplated until it is reviewed and approved according to the procedures in accordance with the acceptance policies, defined in this document. All areas involved in the change request must analyze the change and write a document in which the problem is addressed from the point of view of each department in an exhaustive manner. The documentation must identify the scope of the change, the areas affected, the financial impact, the use of human personnel and the expected date for the implementation of the change at least. The analysis of the change is necessary to assess that it is really possible to achieve the described scope and to ensure that the change has a beneficial result. Once a change request is submitted, it will be known as a change item and will be assigned a change number.

**Review of new change items**

To review the new change elements or change requests, a meeting is established, in which the heads of the different areas will participate and a meeting leader will be available. The meeting leader will need to facilitate communication between participants to get pending changes reviewed, explaining the change so that all participants can know what the change is about. After a consensus of the participants, it is possible to point out the approved and unapproved changes. Changes that are not clear or incomplete in your documentation will be held or deferred.

**Approval and capture of changes**

The authorization of a change depends on several factors, but it is approved after the change has been reviewed, the priority and the benefit it may bring.

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| EXCHANGE RATE AND SIGNIFICANCE ASSESSMENT | | | |
| Type | Authorization | Change of time / Discussion | Grades |
| Standard | This type of change is done on a regular basis and is considered routine. Standard changes are usually created through one of the various change templates available. | These changes bypass the approval process. The Chance Manager team manager always has the option to classify some standard changes as major or emergency, forcing the approval process. | Standard Operating Procedures |
| Emergency | This type of change is usually a response to a bug or bug that urgently needs a fix. Emergency changes need to be made quickly and are usually posted after the change has already been made. | approval required | Emergency |
| Major | This type of change requires many items or dependencies and may require other associated change requests. | approval required | It's not an emergency. Similar to Significant but the impact is less |
| Minor | Small changes or changes that have a small or minor effect are classified in this way. | approval required | It's not an emergency |
| Significan | These changes have a huge impact on the organization. Similar to major, except significant changes may need to be split into several subsequent partial changes that together would constitute one large significant change, depending on your organization's policies and requirements. | approval required | It's not an emergency |

The elements that are not approved by means of the previous table must go through a more extensive review process, in case the change is not approved after two meetings, they must go to an inactive state and be reactivated when it is more useful or when its description is complete.

**Close a change request**

Changes that have been previously approved and subsequently implemented will be reviewed for closure through change meetings. The change owner or a representative must be present at the meeting to discuss the implementation of the change. The change closure review should assess the execution of the change and any impacts to the infrastructure that have occurred. If a change worked correctly or the desired result was obtained, it can be closed. In the event that the change does not work correctly or negatively affects several areas, the change must be eliminated and return to the previous state, in addition the appropriate action must be noted within the change request

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**CONFIGURATION ITEMS**

To analyze the implementation of a new configuration it is important to consider the configuration items related to a change. For this document we will define configuration elements as "An element which intervenes in the business, development, organizational and service infrastructure which is susceptible to changes depending on the context and the needs of the company."

**List of change requirements and related modules.**

|  |  |  |
| --- | --- | --- |
| ID-CR | Name | Affected Modules |
| CR1 | BD Distribuida | BD |
| CR2 | Report Modules | BD, Reports Module, Users Module, page design, new features on the page |
| CR3 | Multi Browser Compatibility | Website design |
| CR4 | Implementation of the sensor module | BD, Creation of the sensor module, IoT Node Module, Web page interface, New features on the page |
| CR5 | Changing the shell design | Case Construction, Sensors, IoT Node |
| CR6 | UV Sensor Integration | NodeIoT casing, NodeIoT |
| CR7 | Deletion of old information | BD |

**Criterios de impacto**

**Evaluation of technical complexity, investment of time and economic impact of a change**

|  |  |  |  |
| --- | --- | --- | --- |
| Métrica | Low | Half | High |
| technical complexity | No additional problems, Simple task | medium complexity | Complex activity, susceptible to errors |
| Time Investments | Short period of time, does not mean an interruption | Moderate time interruption | Long time span, with constant interruptions |
| Economic impact | Slight impact, no effect on project costs | Moderate impact, manageable costs | Significant costs, a serious reduction in revenue |

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**TECHNICAL ANALYSIS**

**CR1- DISTRIBUTED DB**

**Description**

The request has been made to change the implementation of the database from a traditional system to a distributed system.

**Modules Involved**

**DB –** When changing to the distributed database design, it is necessary to create the appropriate infrastructure to fragment and transmit information from different DB nodes to a central or fragmented DB.

**functional impact**

From a functional approach, implementing a system that makes use of a distributed database would facilitate and solve the problems that could arise in a system that seeks to become a robust system with a broad geographical scope, so that it could scale more easily. In addition, it would solve storage, data query and service availability problems.

**Factibilidad Técnica**

From a technical point of view, it is possible to see that focusing the project on a distributed database leads to greater complexity. In general, this type of infrastructure is applied when there is a previous study of the data traffic, being applied in a geographically at strategic points, that is, they have a service locally in the areas where there are the greatest number of requests. Applying this type of technique in the initial stages can present a challenge due to the little information on data traffic that we have.

**Impact on budget and time**

The implementation of a distributed database will imply a greater workload and a greater complexity in the development of the system, which causes a longer time to be required for the development of the system and for its implementation. In the case of the budget, by requiring a greater number of servers or computers that function as database nodes, the cost of the project and its sustainability will increase considerably over time.

**Assessment of Justification**

The concern of the clients can be considered as completely valid, that the service could be saturated and that the storage with which the project is intended to start is not sufficient to store all the data obtained by the Iotnode

**Recursos Humanos**

**About 6 from the software department -** for 21 days

**Required Budget**

**Rental cost of each node approximately – 696 MX pesos for each BD node**

**Conclusion**

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| --- | --- |
| Metrics | Risk |
| technical complexity | High |
| Time Investment | High |
| Economic impact | High |

Although moving the project to a distributed database model can bring many challenges, it is a solution to future problems with requests from different devices and data saturation. Although making this change is very expensive, it is proposed to study the IoT nodes so that they work as monitoring means and as a database node.

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**CR2 - Report Modules**

**Description**

Due to the new regulations in Mexico in relation to environmental monitoring platforms, it is required to provide monthly reports to the state and municipal government, requiring restructuring the reporting module.

**Modules Involved**

**BD –** it may be necessary to create a table that protects the reports

**Reports module –** it is required to restructure the reports module and restructure the requirements according to the new needs

**Users Module –** reports may be required to be associated with the user that generates them.

**Page design –** Depending on the new features, the page structure may change in the reports section.

**New features on the page – t**he necessary code and elements for the implementation of new features will be added

**functional impact**

Currently, there is already a report module, which generates reports, but does not save the report information, the report is created by consulting information from the monitoring table and under some parameters selected by the user, the report is created, which It can be downloaded or viewed at that time by the user, but it is not information that is stored with the user who generated it. In the functional aspect, it would not imply such an abysmal change, but if storage is required, it would cause a serious problem in the database in terms of the space used, implying in turn the need to create a table for reports.

**Technical feasibility**

By having a module that already creates reports, the development or addition of new features to this module should not present a big problem, it could present a degree of complexity if the information is required to be safeguarded, since these would occupy spaces in the database. of data and since the system is aimed at a large group of people, saving reports by user could cause problems.

**Impact on budget and time**

As there is already a report module, this should not present a high degree of complexity in terms of development time, but, if it is required to save information in the database of these reports, the cost that could be involved in safeguarding the user's reports should be considered. .

**Assessment of Justification**

The request is valid since it is a rule that the system must comply with in order to be outside the law, because the Mexican government has established as an obligation that a report on the weather status of the monitored areas be sent to it. But on the other hand, it should be evaluated whether what customers want to comply with the new regulations of the Mexican government can already be achieved with the existing tools.

**Human Resources**

**2 people from the software team – for 14 days**

**Required Budget**

**Approximately required – 640 MX per day, for each programmer**

**Conclusion**

|  |  |
| --- | --- |
| Metrics | Risk |
| technical complexity | Half |
| Time Investment | Half |
| Economic impact | Low |

It is necessary to specify and clarify with the clients how they want to address the issue, since it is considered that the issue can possibly already be addressed with the tools that the system already has.

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**CR3 - Cross Browser Compatibility**

**Descripción**

Customers have made the request for the system to be compatible with multiple browsers and for the system to have a presence on OS such as Linux, Windows and IOS.

**Modules Involved**

**Web page design –** It is required to make sure that the compatibility labels between browsers are present and that the page display is correct.

**functional impact**

The system, as it consists of a website as an output of information, should not present any complexity that the system is found in today's most commercial browsers and in operating systems such as Linux, Windows and IOS.

**Technical feasibility**

It is very feasible that the system complies with this characteristic since, as it is a web medium, there should not be any problem for the system to be compatible with various systems and with various web browsers. In the case of web browsers, there should be no problem that system features cannot function properly as long as the proper tags are used, which is also not a problem.

**Impact on budget and time**

It is not required to invest a lot of time, let alone a large amount of time, for the implementation of these features, but it does require that the test staff and the development team verify that the display of the features is correct in the most commercial browsers.

**Assessment of Justification**

It can be said that this request is partially valid, since it is important that the display of the page is correct in the most commercial browsers and that it matches the type of screen, but in terms of its presence in different operating systems it could be taken more as a reminder that as a change since web pages or websites are independent of operating systems

**Human Resources**

No workflow change required

**Required budget**

No need to invest more money

**Conclusion**

|  |  |
| --- | --- |
| Metrics | Risk |
| technical complexity | Low |
| Time Investment | Low |
| Economic impact | Low |

It can be concluded that this change is not necessary since by default this feature is already found on websites, exhausting some visual elements that require a tag to work in various browsers.

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**CR4 - Implementation of the sensor module**

**Description**

The request to add a specific module for the sensors has been made, in order to facilitate the work of registering the sensors contained in an IoT node.

**Modules Involved**

**BD –** It is required to change the design of the database and add the table of sensors

**Creation of the sensor module –** The design of an interface and its own data backup should be considered for its use.

**IoT Node Module-** By changing the way the sensors are registered in the database, the form of the IoT node will change, the structure of its data and the type of data associated with the IoT node.

**Web page interface –** When creating an individual sensor module, an interface will be created to register new sensors and the IoT node form will be adapted, in addition to adapting the design to the new features.

**New features on the page –** When having new features and new parameters, the queries must be altered to adapt them to the new parameters.

**functional impact**

Regarding the functionality of the final product, implementing the sensors as an external module to the IoT Nodes means greater ease of use of the system, since previously, when registering a new IoT Node, 15 fields had to be filled in with a model of the sensors that the node contained. , when implementing a module for the sensors, it will only be necessary to register the sensors by hand once and then they will be referenced when a new IoT node is created

**Technical feasibility**

It is very feasible to implement this new feature to the system, replacing the varchars of the sensors in the NodoIoT table by foreign keys that refer to the sensor. Regarding the development of this characteristic, it is important to take into account that a table called sensors must be created in which the sensor data will be specified, in addition the many-to-many relationship between the sensors table and the table must be considered. nodoIoT, regarding the web page, the ways of consulting the informative data would change due to the new structure of the database. Which will imply that the database queries where the informative function of the IoT node is implicit must be corrected.

**Impact on budget and time**

Although to carry out this change it is required to implement more hours of work by the development team and in turn generate a cost for these hours of work, it can be affirmed that the benefits of the change are greater than the cost that the development of this feature implies. .

**Assessment of Justification**

This feature implies that changes are made to the design of the database, but considering its function and the benefits that implementing the sensors as a separate entity can bring, the change is considered necessary.

**Human Resources**

2 people from the software team – for 7 days

**Required budget**

Approximately required – 640 MX per day, for each programmer

**Conclusion**

|  |  |
| --- | --- |
| Metrics | Risk |
| technical complexity | Half |
| Time Investment | Half |
| Economic impact | Half |

For this case of change, it was concluded that it is an element which is essential to change for the optimization of the data and to save space in the database, also highlighting the above, adding this feature speeds up the registration of IoT nodes. Therefore, it is suggested to start with the development and design of this feature.

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**CR5 - Change of shell design**

**Description**

The client, in order to eliminate the proximity sensor and lower the costs of the IoT node, has opted for the casing to end in a whore and can be fixed to a wall.

**Modules Involved**

**Construction of the casing –** For this change, an edition will be made to the square model of the IoT node and it will be changed to a model that can be fixed to a wall and that ends in a point.

**Sensors –** When removing the proximity sensor, you want to remove the registration of sensors of this type from the sensor module.

**NodeIoT –** The nodeIoT table must consider one less field of the sensor and when the sensor that was previously considered essential is eliminated, the schematic of the nodoIoT must be changed

**functional impact**

The functional objective of the proximity sensor was to detect the approach of birds, rodents and other animals that could damage the device, with the aim of emitting a noise as a protection measure. Changing the design of the casing to one that ends in a point and that can be fixed to a wall prevents rodents from easily accessing the device and birds from perching on it. In this way, it seeks to reduce the assembly costs of the Iot node and further protect the device.

**Technical feasibility**

Making this change would not mean a big problem, since the design of the new casing was carried out by means of a 3D design program, so that all the components fit in the new design.

**budget and time**

To change the casing, analysis time must be used to make sure that the distribution of the sensors is compatible with the new casing, which would imply assembly and study time by the mechatronics team, in addition, the mechatronics team must be in charge of the design of the new case making sure that the components can be assembled correctly with the new configuration.

**Assessment of Justification**

This change is considered too useful to reduce the costs of building IoT nodes, without losing functionality.

**Human Resources**

2 people from the mechatronics team – for 3 days

**Required budget**

Approximately required – 640 MX per day, for each mechatronic

**Conclusion**

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| --- | --- |
| Metrics | Risk |
| technical complexity | Half |
| Time Investment | Low |
| Economic impact | Low |

The redesign of the device casing called IoT node facilitates the protection of the device and prevents it from being damaged by birds or other animals. Removing the proximity sensor and horn decreases the IoT node assembly complexity, cost, and size and is therefore considered a useful change.

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**CR6 - UV Sensor Integration**

**Description**

The customer found a much cheaper UV sensor model, but the sensor requires the sensor lens to be exposed

**Modules Involved**

**NodoIoT-** The new sensor must be assembled in its respective port depending on whether it is analog or digital

**IoT Node casing –** The casing must be modified or altered so that it has a small opening.

**functional impact**

The integration of a different UV sensor does not imply that the functionality of the IoT node will change, but due to the requirement of the sensor to obtain external solar rays, an opening must be made in the casing.

**Technical feasibility**

Regarding the needs of the UV sensor to obtain sunlight through the outside to determine the amount of UV or ultra violet rays, it was concluded that the casings could be modified to have a hole with a transparent plastic part pointing directly to the UV and luminosity sensor so that they can measure the luminosity and ultraviolet values ​​correctly.

**budget and time**

Small sections of acrylic are required that are well coupled to the casing and a person from mechatronics is required to modify the design of the casing to integrate the use of acrylic into the design for the protection of the equipment from the outside and to allow the corresponding sensors to perform your measurements correctly.

**Assessment of Justification**

As it is a requirement of this sensor, the change must be accepted and given a high priority so that the nodoIoT device can correctly measure the environment.

**Human Resources**

1 person from the mechatronics team – for 2 days

**Required budget**

Approximately required – 640 MX per day, for each mechatronic

**Conclusion**

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| Metrics | Risk |
| technical complexity | Low |
| Time Investment | Low |
| Economic impact | Low |

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**CR7 - Elimination of old information**

**Description**

The client has requested that the system automatically delete information related to environmental monitoring that is one year old

**Modules Involved**

**BD –** It is required to eliminate the information that reaches one year of age, determining it through the date field

**functional impact**

By eliminating the information from the old monitors, it is possible to free up system memory gradually in order to take advantage of the space available for the database, but at the same time you want to protect the data that you want to eliminate in an external list either a file or another means to avoid losing the information permanently

**Technical feasibility**

Performing a partial deletion of a table from the database by means of a date field, is completely feasible by means of a script hosted on the server which is in charge of analyzing the current date with the date of the record and comparing them directly, throwing an event when the information is older than one year.

**budget and time**

Carrying out the development of a script that compares dates and that after the year of the record eliminates the information 'by means of an already preset query should not present a problem and it does not require investing a large amount of time, but it must be analyzed and thought about what way the information that is discarded by means of the script will be saved

**Assessment of Justification**

It is to be evaluated if it is really necessary for the information to be eliminated every year or if it is more convenient to establish a longer date range for the elimination of the information, but as a method to free up space in the database and have more space. for hosting new data it is a good tool.

**Human Resources**

2 people from the software team – for 5 days

**Required budget**

Approximately required – 640 MX per day, for each programmer

**Conclusion**

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| --- | --- |
| Metrics | Risk |
| technical complexity | Half |
| Time Investment | Low |
| Economic impact | Low |

It can be concluded for this change case that it is really necessary to free memory space for the entry of new information and as a means to reduce server costs, but it is really important to establish the time frames for deletion since deleting the information from a year ago deprives us of information that may still be relevant.

**SWOT MODEL FOR CHANGE REQUIREMENT**

**CR1- DISTRIBUTED BD**

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| **Strengths**  Although using a distributed database system implies a technical difficulty, it is possible by means of this change to make a system with greater possibility of growing, with greater stability and with less probability of being operational, either for technical, climatic or due to the fauna of the site. | **weaknesses**  When using a distributed database, it is necessary to use more equipment than a conventional database, in addition to requiring more time to be used for database maintenance in the operational life of the system. |
| **Opportunities**  By implementing a distributed database model, they can facilitate work in the future, since by not containing all the data in a single database, the risk of losing information is avoided, allowing the system to continue to be operational, even if a database node is not operational and it is possible to distribute the load among several nodes. | **threats**  This change has a high cost, when this change is implemented it will require a large change in the database module, in addition to entailing a degree of complexity in terms of its implementation and will require assigning a significant number of employees for the development of this model. Implementing this feature can lead to project delays, excessive use of project monetary resources, and multiple errors when making the change. |

**CR2 - Report Modules**

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| **Strengths**  As there is already a specialized module for reports, the change will not present a technical, functional or even monetary difficulty for its implementation, this is a great advantage over other platforms that must be adapted to the requirement imposed by the government. | **weaknesses**  Being a module that currently does not save the reports within the system, in case it is required to save this information, more storage space will be required for the system. |
| **Opportunities**  Being a platform for environmental monitoring and that complies with the new government regulations, it is possible that financial support can be acquired from the government | **threats**  In the event that government regulations require the safeguarding of the reports, it may be necessary to have a greater storage capacity and it is necessary to evaluate if the reports are stored, for how long it will be necessary to store them. |

**CR3 - Compatibility With Multiple Browsers**

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| **Strengths**  Being a web platform it is relatively easy to make the system present in multiple operating systems without the need to perform a different compilation for each operating system, even adapting the visual characteristics between browsers is very simple since compatibility is linked with a specific label . | **weaknesses**  Being a web platform, it can be considered a disadvantage that an internet connection is required to use it. |
| **Opportunities**  Being a non-compiled platform, it will be available on multiple operating systems from day 1 of launch, without the need for multiple developments | **threats**  As web platforms are too large a market, it is possible that there are emerging pages that can share a similar functionality, for which it is necessary to implement innovative features and that the operation of the page and the design are developed in a way that is pleasant, in addition user-friendly |