

Proposal:

System for the Automatic Monitoring of Activities

SIAC:

Implementation and justification
of costs and benefits

Proceso Digital de Audio

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JUSTIFICATION

Pollution in general and sound pollution in particular is a by-product of economic activity in which environmental resources are used as elements of production and which can produce nuisance to a sector of the population not involved in the productive activity.

This means that an increase in benefits produced by the activity causes a clear detriment to those people not involved in it where that defined by the Pareto Optimum with regard to market efficiency is not fulfilled. Thus, the use of environmental resources by a means of production is the cause of a market externality.

The Pareto Optimum establishes that economic efficiency exists only when it is not possible to improve the well-being of a person without worsening that of others. When these situations occur, in which the benefit of one is clearly opposed to that of many others, the Public Authorities have to intervene in order to remedy this deficiency by means of the implementation of regulations, taxes, licences, etc.

In a situation like the one previously described in which pollution exists which involves people and the environment, in order to evaluate the problem not only the private point of view should be taken into account but also we have to try to obtain a social evaluation. This means that the social costs and benefits will also have to include the private costs and benefits plus certain other externalities.

In the case of sound pollution, with respect to leisure premises in the cities, we find a situation of balance which has been reached by the creation of Regulations and their application to places of leisure. This situation of balance, in which the use of administrative and police measures have led to an improvement in the environmental situation, has not reached the previously mentioned Pareto Optimum, given that, from the point of view of the people affected, the production of noise is increasing in order to obtain the benefit of some, which is detrimental to a large number of other people affected. In this situation new actions for correcting the market are justified and which will improve the effectiveness of the Inspection of Leisure Activities, **charging the costs to the producer of the noise pollution as if it were a new regulatory tax**

According to a survey of the Spanish Centre for Sociological Research in March, 1999 almost 10% of the population suffers from a very significant level of nuisance due to the noise from the different activities. Of these, only 30% would resort to legal action to solve the problem.

This confirms the fact that the majority of the people who are subject to nuisance from noisy activities prefer “to bear it with patience” rather than confront their neighbours. Even so, the noise from leisure activities is the cause of the majority of the complaints to Town Halls and Ombudsmen which occur. These complaints are dealt with using the mechanisms available to the Authorities and give rise to complex enquiries in which very often, when they reach a resolution, the problem has already been resolved. This means that the response of the Authorities is very ineffective given that, on the one hand, they do not have the measures necessary at their disposal to solve the problems which arise from the complaint, and on the other hand, **they do not give an overall solution** since they only act with respect to the facts reported, knowing that these only represent 30% of the reality and that 70% remain unresolved due to the lack of human and technical resources. Moreover, they know that these people should be equally protected by the Authorities.

With this problem in mind, some authorities proposes **a permanent Inspection as a way to resolve the problem of noise.**

The assumption of a proposal like this leads us to the establishment of a monitoring service which affects all the activities without exception.

The setting up of something like this appears at first impossible, not only due to its cost but also because of the impossibility of having sufficient technical and human resources to carry it out.

Thus, it is necessary, in order to improve the conditions in the leisure premises of the cities, to implement measures which make inspection more effective by means of the introduction of an **an Automatic Inspection System for Leisure Premises.**

SYSTEM FOR THE AUTOMATIC MONITORING OF ACTIVITIES (SIAC)

The System for the Automatic Monitoring of Activities proposed by Proceso Digital de Audio is an efficient tool for the Public Authorities capable of:

- Identifying reliably the different activities existing in the area, with each of the characteristics contained in the licence.
- Reporting the time and type of incidents which occur within the activities and which may effect the working within the characteristics of the licence.
- Being sufficiently reliable for the data obtained to be verified within certain reasonable limits.
- Making the activity inspected responsible so that the burden of proof is their responsibility.

It operates as a system of alerts with the following advantages:

- The universality of the inspection. The alert takes place independently of whether there is a complaint or not.
- The inviolability of the equipment from the outside.
- It is an open system which allows the connection of different manufacturers' appliances, since it is sufficient to publish the way of sending the data so that the system understands them (communications protocol).

The system reports information of any incidents daily to the Authorities, classified by:

- **Level:** this detects the sound pressure levels which surpass the levels permitted on the premises.
- **Disconnection of the control element:** report on the possible tampering of the control equipment.
- **Close-down timetable:** report on the opening and closing time.
- **Other functions:** possible breakdowns of the control elements.
 - Register
 - Limiter

IMPLEMENTATION

The system for inspecting activities is based on three propositions:

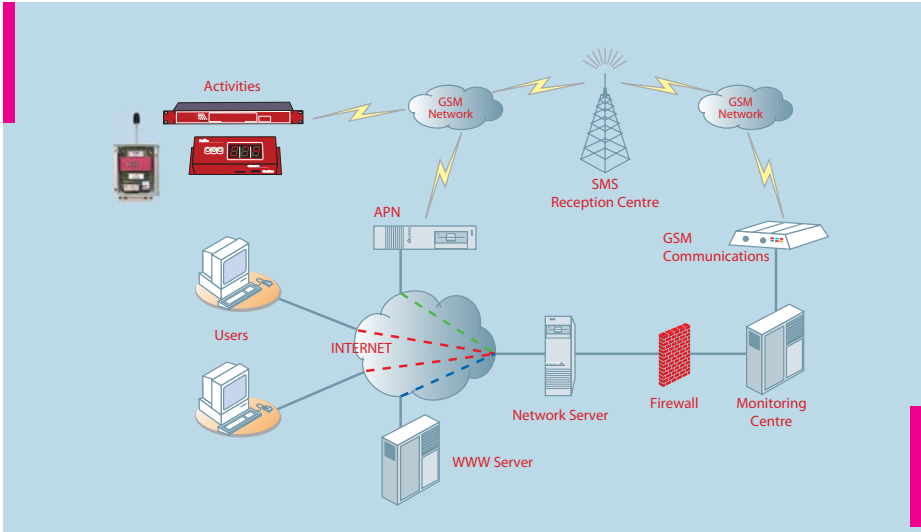
- All premises can tolerate in the interior **a maximum sound pressure level**, so that it fulfils the levels transmitted to adjoining premises and spaces demanded by the Law and which are a function of the soundproofing with the other premises.
- The fact of maintaining the sound pressure levels in the interior of the premises below the **maximum spectrum** guarantees fulfilment of the Law.
- The noise existing in a premises is a function of the sources found in its interior and in particular on the number of persons at the time.

The levels of noise of the activities existing in the interior, especially as regards leisure activities, are due to an indeterminate number of sources of which some are controllable (music systems, tools, equipment, etc) and others which are not (people). If the sound level produced by all the sources is below a **maximum level**, which depends on the building characteristics of the premises and on the levels which it can transmit to its surroundings, we can guarantee that this activity does not transmit noise levels above those permitted by law to its surroundings. Thus, knowing the sound pressure levels existing in the premises which contain the activity, we can determine when these levels surpass the maximum level and, monitoring their progress, we can control the working timetables of the sources.

Thus, if we proceed to:

- the sound cataloguing of the premises to obtain the maximum spectrum of the premises.
- awarding the Licence in accordance with the maximum noise spectrum.
- monitoring the activity by means of the installation of a control device which reports on the activity (sonograph).
- demanding of the person responsible for the activity the correct working of the control device.

We will be able, by means of the incorporation of the information from the control devices in the network of the figure, to set up a SIAC.



The system thus set up reports on all the incidents which take place every day in the activities controlled. **The uniqueness of this inspection proposal is not only the ease of knowing what happens in the activity, but also how these incidents are processed, from the administrative point of view.**

The processing of administrative reports takes up a great amount of resources within the Town Halls, principally at the proof gathering stage. In the proposal which we are making, this process is simplified in the majority of cases.

If we remember that one of the requisites proposed was that the person responsible for the activity should not only have a control element but also that this should work correctly, so that if the system detects an incident (twelve hours after taking place) a report is made by means of a letter in which it is indicated that: **a possible malfunction of the control element has been detected** and that the person responsible has a certain period of time to explain the situation. Thus, the receipt of this document closes the period of proof and the incident is sanctionable due to:

- Acceptance of the incident, in the case where it is shown that the control element is working correctly.
- Or due to the absence of the control element, it is not working or because it is working incorrectly.

COSTS AND BENEFITS INVOLVED

Because of the characteristics of the system, the immediate benefits obtained are:

- The application of the system will make fulfilment of the Regulations more efficient so that the number of complaints will decrease with the subsequent **increase in social benefit**.
- The system transfers the burden of proof onto the person reported. This will produce an improvement in the performance of the Inspection Services, saving time and resources.
- The application of the system will lead to a greater knowledge of the situation which makes it easier to take planning decisions more efficiently and cheaply, **improving the performance of the Authorities responsible**.
- It will allow us to act in known situations by means of complaints and in situations where, due to lack of complaints, the wrongful behaviour of the entrepreneurs was unknown. This produces **an increase in social benefit** since we bring the Pareto Optimum closer to all the situations.

The costs involved in the implantation of the system are:

- The cost of the system which is transferred to the activities and which reflects the private costs of production.
- The social cost for the persons who participate and enjoy the polluting situation.
- The cost derived from the Management of the System and which the local Town Hall assumes.

It is clear that, from the point of view of the cost/benefit analysis, the simple fact of taking the sound polluting situation to the optimum defined by the Regulations, which define the situation desired by the citizens and which consequently obtain the point at which the social costs and benefits are equal, justifies the private costs which have to be applied. These are broken down into the costs of the entrepreneurs and the Town Halls.

FINANCIAL COSTS INVOLVED

The financial costs involved are:

- Installation costs:
 - The equipment on the premises.
 - Local authority equipment
- Maintenance costs:
 - Transmission costs.
 - Costs of storing the information.
 - Costs of servicing, calibration and maintenance of the equipment.

Of all these costs, those which refer to the acquisition and maintenance of the equipment clearly correspond to the people responsible for the acoustic pollution as is stated in the documents of Sustainable Development and defined by the principle that "he who pollutes, pays". Up to a point this is clearly stated in the Noise Law when it obliges the owners of the sources to have elements of self-regulation at their disposal.

The other costs are shared between what is the cost of the inspection – which would correspond to the Town Hall – and what was defined in the first part of this document and which would be the duty/tax which sanctions private benefit in order to compensate the market externality. This concept of taxing is backed up in the previously mentioned Noise Law in which Local Tax Offices are authorised to transfer the costs of inspection onto owners of the sources of noise.

FRAMEWORKS OF RELATIONSHIPS: ACTIVITIES-TOWN HALL

A possible framework of relationships between Activities and Town Hall would be:

- Costs assumed by the Town Hall:
 - Municipal equipment: only once in the life of the system does this take place.
 - Costs of storing information would be an annual cost.
- Costs assumed by the entrepreneurs:
 - Costs of the equipment on the premises.
 - Costs of servicing, calibration and maintenance which ensure the correct working.

To make this situation efficient it is necessary for the application of the Regulations – as regards the equipment which has to be present in the monitoring network – to be across the board. An apparatus that is not in the network implies the automatic suspension of the musical activity, given that according to the regulation framework proposed, the musical activity can not be carried out without “the control element in a perfect working state”.

START-UP MECHANISMS

For starting up the Automatic Inspection of Leisure Activities System, the following steps should be carried out:

- 1 Acquire the necessary equipment by means of regulatory procedures on the part of the Town Hall.
- 2 Enlarge the regulatory framework by justifying the incorporation on the part of the Town Hall of an Automatic Inspection System and define the characteristics which the system has and make public the exchange of information protocols between the control devices and the municipal supervision centre.
- 3 Define the features of the System.
 - Inspection elements and mechanisms.
 - Elements with the capacity to perform the maintenance.

1 Acquisition of the necessary equipment by the Town Hall.

The Town hall will be able to acquire the elements for setting up the supervision centre, the regulatory procedure (open competition) which applies for the “establishment and maintenance of an Automatic Inspection of Leisure Activities System”.

2 Regulatory Requirements

The setting up of the system requires the publication by means of decree or another mechanism of:

- a) The decision of the Town Hall to incorporate an Automatic Inspection of Leisure Activities System by which it can establish a system of data transmission from the control devices to an Inspection Centre.
- b) That, due to the characteristics of the system, the control equipment (limiters) has to incorporate a system of transmission which is capable of sending data to the automatic inspection Service implanted. For this, they have to send information, establish the method (SMS, GPRS or WI-FI) and send the data corresponding to the work sessions of the control device in which figures:
 - Information about the working of the limiter.
 - Information about the levels registered by the register.
- c) Defining clearly the protocols which will govern the reception of the information (an example of these protocols is found in Annex II).
- d) The obligation that the control device must be working perfectly, for which an article with the following content must be published: **“it is the obligation of the owners that the control elements, to which article XX of the Municipal Bylaw for the Protection of the Sound Environment refers, are in perfect working order, otherwise the operation of the musical activity is not allowed. For this, the devices cited will be included within a maintenance programme with Authorised Personnel who ensure the correct working as well as the verification and calibration of the measuring system. This verification should be carried out at least once a year. It is the obligation of the owner of the activity to present up-to-date documentation of the maintenance contract in force and of the certificates affirming the correct working of the control device before the Inspection Service of the Town Hall whenever requested”**.

- e) To define the requirements which the Authorised Personnel must fulfil, and to whom we referred in the previous section, in order to carry out the maintenance of the apparatus. These requirements could be:
- Knowledge and measures:
 - They have to demonstrate a technical capacity by means of the presentation of documents proving the knowledge necessary for the maintenance of the equipment despatched by the manufacturer.
 - To have the necessary measuring device (sonometer), with the appropriate legal requisites.
 - To dispose of a servicing and calibration procedure for the control equipment with the tracking elements necessary and which can be certified by an accreditation body.
 - Liability before the Authorities: given that the reports will have the weight of proof before the legal authorities. If the authorities detect any forgery, a sanction will be applied, which will be imposed and defined by the legal bodies.

3 Defining the Elements of the System

- Inspection elements and mechanisms.
- Elements capable of carrying out the maintenance.

ANNEX II

COMMUNICATIONS PROTOCOL

With the aim of making the sending of data of all the control elements compatible (sonograph-register and limiter-register) with the Automatic Inspection System it is necessary that the data supplied and the way of supplying them to the system fulfil the requirements enumerated below:

The control elements which are installed in the activities subject to the fulfilment of this Regulation should send the newly stored data at least once a day using the GSM network as a medium, using specifically the SMS utility of the GSM network, utilising for each of the data sequences the protocols which are described below and which will be encrusted within the structure of the SMS message, using the user's data field described in the GSM TS 03.38 (V7.0.0), GSM TS 03.40 (V7.1.0) Norms published by the European Telecommunications Standards Institute (ETSI) which defines the network denominated "Digital Cellular Telecommunications System, Global System for Mobile communications (GSM)".

Structure of an SMS to be sent in accordance with the GSM TS 03.40

The structure of the PDU (protocol description unit) of a message to be sent is to be found in Section 9.2.2,1 of the GSM TS 03.40 (V7.1.0) Norm. Here, we can observe the existence of two groups of elements: one corresponds to the data necessary for the message to travel and be identified by the network and another part corresponding to the data of the user.

The TPDU header includes:

- TP-MTI TP: Indicator of the type of message.
- TP-RD TP: Indicator of whether the SC (service centre) admits duplicates.
- TP-VPF TP: indicates whether or not the TP-VP field is present.
- TP-RP TP: indicator of the response path.
- TP-UDHI TP: Indicates that the TP-UD field contains a header.
- TP-SRR TP: Indicator of the report state.
- TP-MR TP: Parameter which identifies the SMS.

- TP-DA TP: direction of destination.
- TP-PID TP: protocol identifier.
- TP-DCS TP: codification identifier in the TP-User Data.
- TP-VP TP: life time of the message.

The following bits of the SMS message contain the data of the user or equally the content of the message we wish to transmit. The SMS message thus has the following structure:



TPDU header + message data = SMS Message

The TPDU header is formed by the fixed sending parameters of the message and concerning which the user can not intervene, if we want the message to travel via the network. Meanwhile, the user data contains the characters corresponding to the content of the message, which are free and the characters which are necessary for understanding the message are positioned. **It is regarding the user data field which the Protocol of the Town Hall of Sanxenxo is defined.**

Data to be sent

The data to be sent by the control elements will be structured as described below:

The data of the devices are divided into:

- The setup or start-up data.
- The session data.

The session data are divided into:

- Data of the sonograph session.
- Data of the register session.



All the data will be packaged and sent using the SMS utility of the GSM network as described by the Norms of the GSM network using the zone assigned to the message to send the data of the devices, as indicated previously. This package will use the 140 characters of 8 bits which define the message within the structure of the SMS.

To normalise the longitudes of the messages received we will use a fixed longitude for each message of 112 which will adopt the following forms depending on the type of data to be transmitted:

GENERAL CONFIGURATION



- TPDU Header**
- Message type**
- Key word**
- Equipment data**
- Equipment type**

The part denominated Header is the part described by the TPDU of the SMS Norm of the GSM.

Afterwards, the key word of the system will be placed, the type of equipment which sends the data and then the type of structure, if it is a setup or it is a session. Finally, the message data will go, as seen in the figure.

The result is the following structures for each type of data.

TIPOS DE ESTRUCTURAS

Common part:	(It forms part of all the messages)
Key word:	8 bytes
Equipment type:	1 byte
Message type:	1 byte
Equipment code:	9 bytes

HEADER MESSAGES FOR THE LIMITER

- Header Information
- Installer: 38 bytes
- Calibration level: 1 byte
- Installation date:
- Date: 3 bytes
- Time, 2 bytes: 5 bytes

Service:

- Date, 3 bytes
- Installer code, 9 bytes: 12 bytes
- Register: 1 byte
- Sonometer: 1 byte
- Refill up to 111 bytes of 8 bits
0x00 are sent: 34 bytes

Number of messages being sent:

- Message number 1 byte (circular numbering from 0 to 255)

SETUP INFORMATION MESSAGE

- Soundproofing: 16 bytes
- NC thresholds: 1 byte (we only send the number)
- Microphone: 16 bytes
- Adjust dBA: 1 byte
- Sensitivity: 1 byte (always negative)
- Calibration: 16 bytes (after correcting)
- Refill up to 111 bytes of 8 bits
0x00 are sent: 26 bytes

Number of messages being sent

- Message number 1 byte (circular numbering from 0 to 255)

LIMITER SESSION MESSAGE WITH SONOGRAPH INFORMATION

- Session Index: 2 bytes
- Start-up session date
- Date: 3 bytes
- Time, 2 bytes: 5 bytes
- Final (minutes from start-up): 2 bytes
- Calibration: 1 byte
- Red: 1 byte
- Amber: 1 byte
- Maximum power: 1 byte
- Average level: 1 byte
- Maximum level 1 byte (x2): 2 bytes
- Maximum microphone time: 2 bytes (x2) 4 bytes
- Microphone min: 1 byte
- Refill up to 111 bytes of 8 bits
0x0 are sent: 74 bytes

Number of messages being sent

- Message number 1 byte (circular numbering from 0 to 255)

SESSION MESSAGE FOR LIMITER WITH REGISTER

- Session start-up date 5 bytes
- Session index 2 bytes
- Interval measurements 1 byte
- Register message number 1 byte

Register measurements per message

- Maximum of 83 measurements, if there are fewer it is refilled with 0x0 up to 83 bytes

Number of messages being sent

- Number of messages 1 byte (circular number from 0 to 255)

¿Esta bien dos veces
"Date of session start-up"?

MEANING OF THE VARIABLES

Adjust dBA: this is the calibration number of the microphone. It may be zero when the number transmitted is already dB(A).

Amber: working time of the equipment.

Average level: sound pressure level measured by the microphone during the session.

Calibration: these are the levels in thirds of octaves which identify the maximum emission of the music equipment where the limiter is installed.

Calibration: value of the start-up calibration of the equipment.

Date of session start-up: date and time of session start-up.

Date of session start-up: date and time of session start-up of the register.

Equipment code: this unequivocally identifies the device in the system. It may be the series number of the apparatus.

Final: length of time of the session. It is packaged as a four-figure whole number (4 bits for each one).

Installation date: this is the date and time at which the equipment was installed.

Installer: this is a field reserved for giving information concerning the installation.

Interval measured: interval of time between the samples.

Key word: this is an identification word for the system which has to be requested from the Town Hall when we want to incorporate a specific device to the system.

Level: this identifies the calibration level of the equipment (maximum level that it is capable of producing).

Maximum level: maximum sound pressure level in the session.

¿Esta bien dos veces
"Session index?"

Maximum microphone time: time at which the maximum sound pressure occurs.

Maximum power: maximum level existing in the line during the session.

Message number: this is the number of the message counter which indicates the number and order of the messages.

Message type: this identifies the type of message. The content is given by the Town Hall when incorporation into the system is requested.

Microphone: these are the numbers which represent the sensitivity of the microphone in thirds of octaves.

Min. microphone: minimum sound pressure level in the session.

NC thresholds: this represents the number of the NC curve which adjusts the spectrum to be protected.

Red: total operating time of the equipment.

Register: this indicates whether the equipment has a register installed.

Sensitivity: the overall sensitivity of the microphone.

Service: this is the date and time in which access to the equipment takes place and the identity of the installer who does it (the latter can be substituted for a fixed code).

✓ **Session index:** number of order of register session.

Session index: number of session order which is starting up.

Sonometer: this indicates whether the equipment has a sonometer installed.

Soundproofing: this is the value of soundproofing in thirds of octaves on the premises.

Type of Equipment: this identifies the type of device in the system. The content is given by the Town Hall when incorporation is requested.

