

DESIGN AND DEVELOPMENT OF SOLUTIONS FOR RESEARCH PROJECTS: UPPER, CITYCHAIN AND PULSE GENERATOR

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ABSTRACT: This paper describes the research work done in several projects. These projects have a different scope, from the monitoring of a city to the safety of workers in their workplaces. The solutions provided in these projects are focused on custom electronics and IoT technology.

KEYWORDS: Electronic.

1 Introduction

In this document my contributions to the different projects of the Bisite Group will be presented and developed. These participations have been in the projects of:

- Pulse generator for the stimulation of peripheral nerves in experimental animals
- Citychain
- Upper

1.1 Problem description

According to the Project, the problem to face is different:

a) Pulse generator for the stimulation of peripheral nerves in experimental animals

Vagus nerve stimulation (VNS) has been applied in the clinic for more than two decades, but even so, the fundamental mechanisms underlying the improvement that the procedure induces in epilepsy are not entirely clear, so it is essential to continue research on the subject [1-14].

b) Citychain

The concept of Smart Cities has emerged with great intensity in recent years and its influence on our lives will continue to be increasingly evident. Some cities have begun to promote themselves as intelligent, to demonstrate their technological adaptation, attract new citizens and external investments, as well as retain those who already live there and the investments that have already been made [15-23].

Under this idea, cities play an important role, both as large data generators and as places where new services can be deployed and shown to all citizens, which impacts on their ability to generate income. Although several case studies have already demonstrated these benefits, a very low percentage of cities in the world, mainly large cities, have joined this trend and in most cases use proprietary software. The fact that this software is proprietary prevents an evolution of these management platforms, the community can develop external modules that can be coupled to the system to extend the existing functionality [24-37].

c) Upper

Safety and health in the workplace is one of the challenges that generate most concern within the business world and especially in the industrial sector. In this sense, the strategies of organizations and their teams dedicated to safety and health in the workplace, focus on training and making available to workers, the means necessary to reduce risks, which otherwise could lead to an occupational disease or an accident [38-43].

Nowadays, the available technology makes it possible to approach these problems from a similar approach, but abandoning traditional training actions and obsolete personal protective equipment (PPE), disconnected from the real environment where the working day takes place and lacking in personalization and adaptation to the particular needs of each worker.

1.2 Reasons

Motivation has been common in all three projects, where the focus of progress has been on improving and making cheaper products and ways of using current technology, in an equally effective but more economical way, while at the same time trying to find a new approach to its use that provides features that are not exploited as much as possible or in a different way. Likewise, the use of new elements and technologies in all these projects has meant the need to understand and implement these technologies in the elements to be created, which has been a constant challenge that has given the team a continuous impulse to advance in the project [44-58].

1.3 Brief description of solution

a) **Pulse generator for the stimulation of peripheral nerves in experimental animals**

A PCB has been designed and created, whose function is to generate electrical impulses that are programmable, and that allows its implantation in a chronic way in the GASH/Sal. This board has been designed with connections both for the battery or power battery and for the connection of the electrodes that will be in contact with the vagus nerve.

b) **Citychain**

The hardware team has overseen the design and production of the plates that will be incorporated in the Citychain project. Modular plates have been created different plates with different functionalities each one, which can be joined, obtaining the combined functions of them as required.

c) **Upper**

Different devices have been created: a helmet, a bracelet and a belt, which have different sensors and elements incorporated, in such a way that each one of them is in charge both of collecting data from different variables and of acting in the prevention of occupational risks, depending on the values captured.

2 Materials and methods

a) Pulse generator for the stimulation of peripheral nerves in experimental animals

With regard to the decision whether or not to use rechargeable batteries, it was finally decided that they would be non-rechargeable, as rechargeable batteries increased in size and price, and the estimated lifetime of certain non-rechargeable batteries (such as the one finally chosen as the best option) is sufficient for the purpose of the project.

We have tried to create the smallest possible size, whose main limitation has been the size of the battery, which is greater than desired and what could have been the PCB itself, in addition to its thickness is considerable with respect to the plate and the ideally sought [59-63].

Even so, we have created a plate of reduced size, with circular form, whose activation is carried out with a magnetic switch of which it is provided.

b) Citychain

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c) Upper

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3 Conclusions

Based on the results obtained so far, we can say that progress in these projects is taking shape, and the proposed objectives have been achieved satisfactorily. The Upper prototypes are almost finished, the Citychain plates are

already functional, and the electric impulse generation plates are already being tested with the mice. Teamwork has been key to solving the problems that have arisen throughout the different processes of design, testing, creation and other phases of development.

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