ALIGER

AWARE, LIVE & INNOVATIVE GADGET FOR ENVIRONMENT RESOURCES PROJECT

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PROJETO FINAL SUBMETIDO AO CORPO DOCENTE DO INSTITUTO ALBERTO LUIZ COIMBRA DE PÓS0GRADUAÇÃO E PESQUISA DE ENGENHARIA (COPPE) DA UNIVERSIDADE FEDERAL DO RIO DE JANEIRO COMO PARTE DOS REQUISITOS NECESSÁRIOS PARA A OBTENÇÃO DO GRAU DE ESPECIALISTA EM GESTÃO DO CONHECIMENTO E INTELIGÊNCIA EMPRESARIAL.

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Programa: Engenharia de Produção

O projeto é o desenvolvimento de um sistema inteligente (plataforma em nuvens), baseado no conceito de Internet das Coisas e em métodos de Inteligência Artificial. Propomos a produção de smarthubs, com protocolos abertos, e sensores, para serem instalados em residências. O objetivo é desenvolver o mercado de automação residencial e promover a geração de dados de hábitos de consumo de forma a tornar o mundo mais sustentável e facilitar o cotidiano das pessoas. Um consórcio internacional foi formado para atender o edital de um programa de incentivo à Pesquisa e Inovação lançado pela União Europeia, o Horizonte 2020. O resultado foi a elaboração de um plano de implementação de um protótipo prevendo a disseminação e comunicação dos resultados via instituições acadêmicas e organizações de consumidoresenvolvidas.

PALAVRAS-CHAVE

Internet das coisas. Inteligência artificial. Automação Residencial.Big Data.Associação de consumidores.Economia de baixocarbono.Pegadaecológica.Smart hub.Smart Grid.Sustentabilidade.Domótica.

Abstract of Final Project presented to COPPE/UFRJ as a partial fulfillment of the requirements for the degree of specialist in Knowledge Management and Enterprise Intelligence

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Maio/2017

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The project is the development of a smart system (cloud platform) based in Internet of Things and in Artificial Intelligent methods. We propose the production of a smarthub, with opened protocols, and sensors, to be installed in houses. The aim objective is to develop the home automation market and to generate data of consume habits in order to support a sustainable world and to make easier the daily lives. An international consortium was formed to attend an EU Research and Innovation programme, the Horizon 2020. The result was the elaboration of a plan for a pilot implementation that foresees the dissemination and communication of the results, through academic institutions and consumer organizations involved.

KEY WORDS

Internet of things.Artificial intelligence.Residential automation.Big Data.Consumer Organization.Low carbon economy. Ecological footprint.Smarthub.Smart Grid.Sustainability.Domotic.

Summary

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ABBREVIATIONS

IoT	Internet of Things
ALIGER	Aware, Live & Innovative Gadget for Environment Resources
AL	ALIGER
AI	Artificial Intelligence
CO_2	Carbon Dioxide
HVAC	Heating, Ventilation and Air Conditioning
RS Gateway	Rockwell Software
API	Application Program Interface
CDD	Charge-coupled Device
UK	United Kingdom
UUID	Universally Unique Identifier
MAC	Media Access Control
NILM	Non-Intrusive Load Monitor
OWASP	Open Web Application Security Project
STEM	Science, Technology, Engineering& Mathematics
GPRS	General Packet Radio Service
AC	Air Conditioner
HAM	Amateur
EU	European Union
WP	Work Package
UFRJ	National University from Rio de Janeiro
UFMT	National University from Mato Grosso
UFPE	National University from Pernambuco
PT	Proteste – Brazilian Consumer Organization
AL	Altroconsumo – Italian Consumer Organization

OCU	Spanish Consumer Organization
TA	Test-Achats – Belgium Consumer Organization
ODI	Open Data Institute
CP	Coppe–Engineer Institute from UFRJ
HS	HochschuleRheinMain University (Germany)
UPS	Paris Sud University (France)
ISI	Senai Innovation Institute (Brazil)
SENAI	National Industrial Learning Service (Brazil)

1. INTRODUCTION

Have you ever thought of how useful if we could control house functionalities by phone? What if we could control the daily consume of water and electricity getting the data in the real time? What if you live home and forget the air conditioner on and it could get off automatically?

This kind of thing is possible thanks to Internet of things (IoT): systems that make the objects to "dialog" between them, in order to facilitate our lives.

The term Internet of Thing was used for the first time by Kevin Ashton, in 1999. In his article, written ten years later in RFID Journal, he says that nowadays the "information technology is so dependent on data originated by people".

For him "If we had computers that knew everything there was to know about things—using data they gathered without any help from us—we would be able to track and count everything, and greatly reduce waste, loss and cost. We would know when things needed replacing, repairing or recalling, and whether they were fresh or past their best". (RFID Journal, 2009) [1]

Since the first years of internet, TI specialists are creating projects to develop homes devices and domestic spaces, but just with the IoT, house can be more integrated, electrical devices can "talk to each other", making easier our daily activities. We are facing an increasingly number of objects able to be connected to the world wide computers, called Internet of Things (IoT). In 2019, they estimate almost 35 billion of devices will be communicating to each other using internet [2]. It means four times more than the total number of people in the world, related to the estimated population for that year.

Gartner estimate IoT products and services providers could gross over US$ 300 billion till 2020. (apud CIO, 2017) [3]

Chris Allen Vein, Chief Innovation Officer for Global ICT Development of World Bank said "The Internet of Things can be a game-changer for the world's economies - accelerating productivity, overcoming infrastructure gaps and driving innovation". [4]

According to GfK Consulting, 90% of Brazilians know what is a smart house and 57% consider the home automation will impact their lives, more than connected cars and cloud computing, in the next 5 years. (apud O Estado de São Paulo, 2015), [5]

This project is the development of a cloud platform founded with Internet of Things concept. A proposal is for the installation of an intelligent hub, based on open communication protocols, with market standards and with the aim of fostering interoperability of applications. The consortium wants to foment a change of behaviour. From the data collected in these devices, performance analysis will be performed and consumption habits identified by consumer associations. Helping the consumer to save energy and providing detailed information of each equipment, improving the comparison between the household appliances.

We submitted this project to Europe Union (EU) - Brazil joint call of Horizon 2020 programme [6], the biggest EU Research and Innovation programme ever, with nearly € 80 billion of funding available over 7 years (2014 to 2020). We applied to H2020-EUB-2017 and IoT Pilots was one out of three theme topics for the proposals [7].

By the time of the presentation of this project to COPPE/UFRJ we are within the 5 months evaluation time from the final date for submission (March, 14).

In the second chapter we present the objectives and the innovations to be tested. We also relate to scope of the EU work programme. The smart platform is showed and its modules are descripted. Finally, we list some functions of the consortium (see item 4.3) and our ambitions.

The third chapter lists eight different stakeholders and how they can be impacted by the results, the measures to maximise impact and our first prototype already developed.

All steps of how this project will run are described in the fourth chapter. We separated the activities in work packages. Each work package is related to a key working area. In this part, we describe the work, its duration; we specify the tasks, objectives, and the expected deliverables. Also, a subtopic is dedicated to management structure, milestones and procedures. In the last sub-item of this chapter and in the fifth one, we list all the members of the consortium and a description of each one of them.

Finally, for conclusions, we cite some expectations for the best evaluation of the UE submission and the values to be generated related to implementation of a pilot.

2. EXCELLENCE

2.1 OBJECTIVES

ALIGER is the acronym of Aware, Live & Innovative Gadget for Environment Resources project.

Its aim objective is to develop an smart system based in Artificial Intelligent methods to read wide amount of data from market and open homologated sensors, learning and taking decisions to predict the wisest way of use renewable resources, reversing the contemporary tendency of exhausting environment.

Let the machines do what they do better than human is not enough. In this project, we will test in real life situations some innovations, as:

1. Knowledge Management Plan to make consumers aware and early adopt transformation behavior to find the best sustainable practices;

2. Digital business model alternatives to find the best option to get a sustainable, replicable, reliable and great traction worldwide innovative business model;

3. Meritocracy system of incentives, based in gamification technology to rank consumers according to their responsible attitudes, behavior changes, adoption of best practices, as well trying to incentive an ambassador program to spread best practices in some geographies;

4. Electronic prototypes, not available at the market yet, as behavior camera to evaluate the feasibility, possible demand size and price to market;

5. ALIGER platform could help consumers to achieve at least 20% of cost reduction from natural resources using Artificial Intelligence platform enabled to recommend the best way to achieve this goal;

6. The reliability and integrity of wide range of data types generated by a diversity of IoT sensors available at market, as well their applications in real life use;

7. Fifteen biomedical sensors available at market to understand how ALIGER platform could work, support better and make recommendations for better living, including chronical diseases monitoring, effects and measures correlation and data fusion and what we can conclude with the benefits of an AI system and their possible risks. Understand the legal, confidentiality, integrity and medical protocols and standards and possible problems and needs to mitigate risks before future launch in the market;

8. Customer research interactive system to enable customer to participate in specific researches and win points and prizes with meritocracy system of incentives;

9. New technology for food management, including IoT button, inbound and outbound food control, including food data validity control and alerts to use food before it screws up;

10. New technology for organic material dispose based in vermicomposting boxes, controlled by sensors;

11. New technology for low cost micro irrigation system for green houses,apartments and agriculture, experimenting some methods to calculate the right amount of water according to external temperature, humidity and other information that could co-related to find most efficient method to be learned by AI platform.

12. Include in the IoT premises the consumer perspective that will allow the Consumer Organization to evaluate the consumer and equipment behavior. It will increase the knowledge of how the families use the household appliance, the enrgy and the natural resources, and increase the capability of those organizations to indicate the better choice, for product and services, to consumer.

2.2 RELATION TO THE WORK PROGRAMME

ALIGER proposal relates to the work program “Information and Communication Technologies” under the topic “IoT Pilots” and addresses, at the same time, four out five distinct areas of interest for EU-Brazil collaboration: Environment Monitoring; Water Smart Management; Energy Management in Houses and Buildings; Smart Assisted Living and Well Being.

2.3 CONCEPT AND METHODOLOGY

a) CONCEPT

The low carbon emission is the expression of order for the economy of the 21st century and means innovating productive processes and technologies that result in less impact on the natural resources of the planet emphasizing the search for efficiency and alternative energy, reduction of gas emissions, mainly carbon dioxide - CO_2 and sustainability management.

Our planet has finite resources. Therefore, it does not mean that we can abuse natural resources thinking that will have clean water, food and fresh air forever. We cannot remain inert waiting for divine or third-party action to change this unfavorable scenario. We believe that the use of technology and networks can be the key elements to raise the awareness of as many citizens as possible, to improve the processes of production, repair, disposal, mitigation, optimization, reuse and more intelligent management of these resources, thus reversing this trend who have been so worried about the prudent who care about the next generations.

An estimated population of more than 7 billion inhabitants on our planet, the rising cost of energy production, the scarcity of food and natural resources and abundance of garbage in the world. So, it becomes imperative to think of a wiser way to optimize these resources and their use, be it in homes, industries and commercial ventures, for a life that has more significance for humanity.

Considering the advancement of longevity, increase of chronic diseases, as well, the diseases created by modernity, lack of healthy habits, stress caused by overwork, pollution, sloppiness, contamination, and other contemporary traps represent the greatest cause of death. These factors do not necessarily lead to a population balance on the planet, since a few decades ago the number of people born is much higher than death.

With technology advance of the contemporaneity age, the increase of computer power capacity and decrease of electronics components costs, has become new applications and getting decreased costs. Nowadays we usually carry in our pocket a smartphone with many times the computational capacity that was necessary to take the man to the moon. Instead of learning the language of the computers, they learned ours. Its

cognitive interfaces enable us to give and receive commands by voice and use cameras as presence sensors, counting people, recognizing shapes and patterns, among other unthinkable applications until then.

The main consequence of these technologies is the increase of data and the difficult to analyze large amounts of data to deliver valuable information that customers probably would never aware. The problem today is not the technology available to acquisition of data as sensors for use in healthcare, environment, smart cities and other application, but what to do with this amount of data generated by thousand devices per second. The information is available at source premises, making it necessary to merge this information, as well as intelligent curatorship to identify what matters most to take the right decision.

Our main challenge at ALIGER project is to create a smart way to proceed with a data fusion from wide range of sources, including multiple sensors, applications and information available through the internet as climate databases, geographic information systems to process, and so on. Correlating and curate this huge amount of data to feed an expert system aiming to address challenges and make recommendations based in computer learning and consumer best practices.

The use of distributed algorithms and methods of Artificial Intelligence in this project, go further than classify and organize data. Some new AI methods that we already have experienced, would be more effective to process, analyzing and correlate information smartly. Using deep learning and neural networks, we can provide to customers and stakeholders the best recommendation to solve their problem, learned from real life data and behaviors collected from sensors, also based in expected best practices, as well user success cases and other reliable sources.

We will increase the security through authentication, cryptograph, secure communication among devices and transaction integrity methods to minimize data theft or lack of data integrity. The most important part of this future business will be information supply business model, using a multilateral platform concept to get together all stakeholders, as well make some anonymous data available for free, aiming to incentive new ecosystem of partners and startups that could use this data to generate innovative solutions to the market. To certify high level of integrity and mitigation of

the risks, Open Data institute will be working with us to assure best practices and standards will be adopted.

As expected results of ALIGER Project will be enable stakeholders and customers to get the best recommendation of use, sustainable best practices and goal achievement to use lower cost and lower carbon emission uses, best utility company to hire dependent of time, customer user profile or other criteria. With preemptive features available, will be possible to determine how much customer would like to pay for utilities company monthly or even maximum carbon emission. The system will recommend the best use profile, adjusting automatically all system to achieve this goal, even considering micro climate data at customer premises geography.

To make easier to interact with ALIGER platform, system will be enable to connect to market standard wide range of cognitive interfaces as Amazon Alexa, Apple Siri, IBM Watson and others, enable them to communicate with system using voice commands and receiving voice recommendations or questions. While most of IoT platforms at market provide an app with a lot of graphics and useless information on it screens, we provide the right information also by voice, telling user to reduce temperature of HVAC to save 10% this month asking them if would like system to make these adjustments for the user. We will be able to manage and automatically configure, adjust, turn on or turn off devices and applications with user explicit authorization.

Industries and customer associations will have rich data sets of information, including consumer best practices profiles based in geography, demography, real use cases, climate, water reuse, recycle, sewage treatment, CO_2 emission indexes, and many other particularities. This information will enable a new generation of smart appliances according to customer demands, lower energy and CO_2 emissions as well empowering customer associations to provide high quality information about products and their uses to make life better for all stakeholders and society.

Our beliefs and lessons learned will feed the knowledge management plan for user awareness. We know that most of the times user are aware to reduce water consumption, reduce energy, reduce CO_2 emissions, use food in the period of validity, don’t take long shower, increase reuse of water, discard fewer sewage and many other environment friendly activities. With this Knowledge Management plan, we intend to improve activities, enabling customers change behavior, re-educating them to adopt new

healthy habits for their well-beings and for environment, culminating in a better and smarter way of living well.

Our meritocracy system of incentives and ambassador program will promote best practices in each geography, using gamification technology to provide incentives, prizes, points, discounts to improve customer engagement, awareness and promoting replicable behaviors, actions and use of technology to new customers.

All the technology developed bellow “ALIGER Artificial Awareness Cloud platform” can be replicated by consumers worldwide, anyplace that consumers can buy an open hardware platform based in Raspberry Pi, some homologated (by us) market meters, sensors and actuators. Just download our Rosetta Stone Gateway open software from web (our github open software repository), install it on Raspberry Pi, install sensors and other devices, connect all of them to Rosetta Stone Gateway, then register the gateway at our cloud platform and it is ready to use. Consumers can do it by themselves using our step by step video library community support, or hire some local certified specialist to implement complete solution for a service fee, or even buy products, sensors and other parts from them. And thus, creating new opportunities for unemployed people provide services, new startups or small business companies, bringing social benefits, jobs and knowledge for local community.

When a new powerful hardware is demanded to implement new features to Rosetta Stone Gateway, consumers just need to buy an updated model of raspberry pi or other open standard hardware homologated to work as new RS gateway. We are very worried in how to discard old electronics devices in a sustainable way. Preaching the recycle concept of re-purpose (find a new use for an outdated device), customers can donate raspberry pi old gateway hardware and sensors to any school. It will be used satisfactorily to teach kids to learn to code, as well a good introduce to electronics development. This attitude will directly contribute to increase of interest in STEM (Science, Technology, Engineering& Mathematics) training. Besides that, re-purpose actions will increase the points at customer profile in our meritocracy system of incentives.

Finally, we intend to let computer and technology do what it does better, while we, humans use our time and dedication to live a valuable life, that worth living. With modernity and revolutions, be they industrial or cognitive, the world has lived and is experiencing waves of innovation, where technology provides us with tools that, when used with wisdom, parsimony and ethics can significantly help us to overcome the challenge of reversing destruction of human race and the environment.

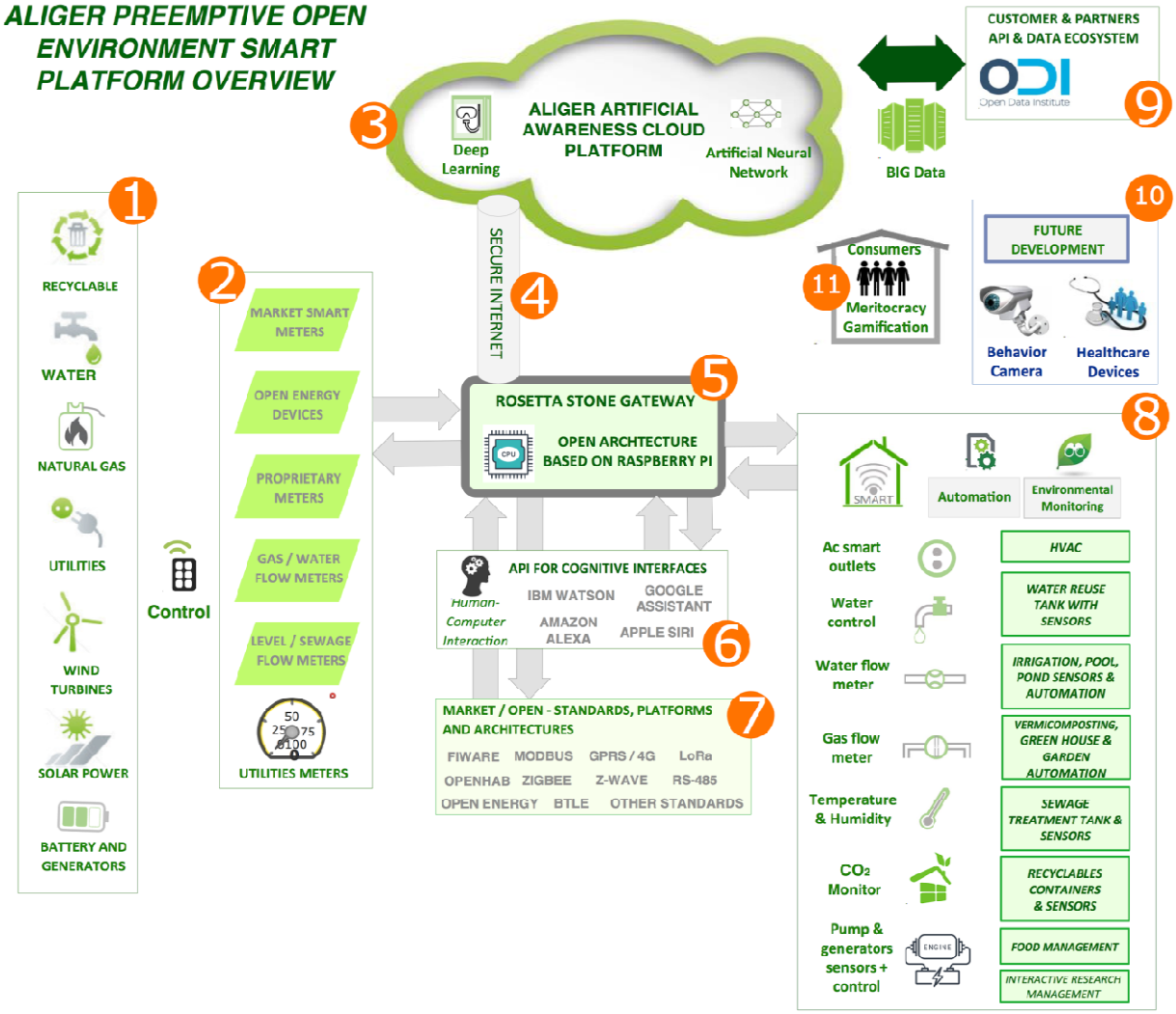

Figure 1: Aliger Preemptive OpenEnvironment Smart Platform Overview

MODULES DESCRIPTION:

(1) ENERGY SOURCES & UTILITIES SERVICES:

Our open platform will be able to support, connect, read and control a wide range of homologated meters. Some of them are smart, that provides smart grid resources as great benefits to consumers. Unfortunately, according to geography and the technology used by utility company's plants, most of the meters installed by these companies do not provide any valuable information to consumers beyond utilities bills.

Some energy sources usually installed by consumer already have interfaces that enable connection between this devices and other interfaces, as gateways for example. Most of the times we need to convert some proprietary information protocol to connect to our Rosetta Stone Gateway using any wireless technology, according to distances, geography and other parameters. Sometimes we need to develop this interface or even find a way to connect a resource or service provided by a utility company to our system. Some services are hard to do it because local regulations or security reasons and we need to implement optical sensors to read or sensors and actuators after meter installed by utility or service company.

Regarding to recyclable resources, our sensors can weight each kind of recyclable container (metal, glass, paper and so on), as well take measure to know if it is full of material or not, improving collecting company services and notifying them before if any container is full to optimize the route of the trucks. At customer side, this information will be transmitted to ALIGER platform cloud through Rosetta Stone gateway and will be used to correlate with other data, system learning and consequently increasing points in the customer profile in our meritocracy system of incentives, according to recycled material quantity, weight or even the lack of it, that could reflect good habits of customer when they select the products to purchase. This attitude may represent wisdom, since choosing products with reusable packaging is often more efficient than buying cheaper products that would spend more energy and generate more pollution to recycle and return it to the market. Our system must be very smart to gather this data and take the right analysis and decision, considering dubious situations like this.

Our system considers connect many sources of energy and resources to manage and control them, but these challenges most of the times would be solved adding other devices as described in next topic, number 2.

(2) ENVIRONMENT METERS:

It has become necessary to identify in the market sensors and meters capable not only of informing the consumption of energy, water and gas, but mainly interact with our platform to interrupt or adjust the flows and services according to the demand. Or even have ability to adjust the mix of demanded power, prioritizing renewable energy, managing batteries, generators or even several energy suppliers efficiently with the benefits of the intelligence provided by ALIGER Platform.

We intend to homologate a wide range of devices for all pocket sizes. Devices from open energy in UK has open hardware and software, cheap device, that could be acquired by web or even mounted for those who understand basics of Arduino or hardware. In the middle of the class, developed in Belgium, we have Smappee [8] family of meters, with more features, but more expensive. It has the ability of identify voracious energy consumption appliances at home, but most of the times, customer should inform the system that one referred behavior is related to a specific appliance. For those not identified by the system or by user, a specific outlet can be used to take measures not identified by Smappee system.

In the top of line, more complete and more expensive we have some meters developed in Brazil that uses neural networks, high sensibility meters to detect harmonicas interferences generated by each device on power line to identify and classify the respective appliance. This technology is well known by the name of NILM – Non-Intrusive Load Monitor. It has been improved for more than 7 years, with a hit rate greater than 75%. The main villain is inverter technology HVAC and refrigerators, hard to identify the load. Some countries of Europe HVAC systems still use conventional technology, so we can achieve a hit rate of most than 100% even in 3 phases circuits.

Regarding to water and sewage, the most important is to take measure and control (on/off/reduce/increase) the flows, letting ALIGER platform understand the quantity and quality of inbound water, as well the level of water available at reservoir, including

the water for reuse. Regarding to sewage, if customer has treatment plant, we can monitor quantity and quality in each phase, including discarded material even if it uses organic method based in activated sludge or plants tank. In chemical treatment plants, ALIGER platform can activate pumps to dispense the right quantity of chemical products at the right time to adjust the parameters getting the best efficiency possible.

(3) ALIGER ARTIFICIAL AWARENESS CLOUD PLATFORM:

We are faced with the emergence of new types of products and services, in addition to a change in the industry itself, where the use of data becomes one of the most important assets.We already produce a much larger amount of information than we can process as humans and even greater than we can process with machines.

The last four decades brought gradual technological evolutions that allowed more and more information in this everlasting ocean of bytes: in the 80s we had the popularization of the personal computer; In the 1990s the evolution of telecommunications with the commercial Internet and various types of wireless networks; In the next decade, the smartphones arrived and in the current decade we are facing the rise of the Internet of Things (IoT).

The amount of information produced is so great that a few years ago a new term - Big Data - was created to refer to large amounts of data. The concept does not just refer to a gigantic volume of data. It either refer to a simply box where data comes in from various sources and several dollar bills come out, thanks to the magical discovery of strategic information for the business. This is the only scenario that is usually demonstrated only in slides of some companies when they present their solutions for Big Data.

Although the origin of the term came from the academic world, the first popular description of what would be Big Data is assigned to the Gartner Group, which used three "V" letters to explain what makes up this concept: Velocity (continuously data production); Variety (data of different types and sources - spreadsheets, social networks, videos, sensor data, etc.) and; Volume (huge amount of data) Therefore, "volume" is not the only thing that makes it up. According to this definition, 50 terabytes of employee work records only would not be Big Data.

Both industry and academia, Big Data was discussed with other features. Following the Gartner concept to use the "V", was also added Veracity, Volatility and Feasibility. However, there is also another "V" that is strategic to any business: Value. The economy of the 21st century is increasingly based on information, which would be the major competitive advantage for various businesses. It is crucial to know what kind of data or information can be collected and whether that can generate value for the company's strategy. Most of the competitors are focused in make available information on the web or even in apps. Users are bombarded with nice graphics and data all the time, without any useful information to take decisions, or even actions.

It is important to choose the most appropriate techniques to extract the desired information, as well as to evaluate if there is any need for a quick response. First, not all the data collected will be useful. It is important to do some sort of data cleansing, for example, by eliminating duplicates. Another important point concerns timing. The use of typical Big Data started with batch processing to extract information or make predictions over the masses of data acquired by applying techniques useful for analytics, such as machine learning.

However, in IoT scenarios it is recurrent to analyze the data in real time, as they are collected, to allow fast decision making. In this case, the processing of information takes place through data flow processing techniques or even process these data on it place or origin. There are at least two strategies for analyzing data in this context: modeling and mapping events that will be notified when they happen or using techniques that uncover trends in the data.

At first, we already know the problem. In the second, we want to discover something we do not know. The critical factor of success to take seriously is time. Depending on the scenario, the delay in collecting or processing data may generate information that has lost its usefulness (elderly monitoring, industrial applications, traffic, among others that demand real time). Failures like these can lead to an endless legal battle. In these cases, we do not get a second chance, especially when it comes to human lives. Fail is not an option.

In the ALIGER Project, we intend to use Artificial Intelligence technology and tools to evaluate in real-time and at real-life situations a wide range of sensors, with many types of data to innovate, develop and build an "artificial awareness" cloud to deal with these

Challenges and to make reliable predictions and recommendations to consumers. We intend to interact with them, not only by the web or the application, as the competitors do, but also with cognitive interfaces, using natural language and computer vision technologies already available and widespread in the market. One of our goals is to test our AI technology in a variety of situations to improve it, make more reliable before came out to the market.

(4) SECURE INTERNET CONNECTION:

Beyond the data about ourselves that we are generating on the Internet and on social networks, more and more things around us are doing the same. Two significant concerns that arise around the use of this data collected by devices are about security and privacy. Companies that adopt data collection strategies for the use of their products and services must be clear from the beginning of relationship about how the data is stored and which data are being read and transmitted and it purposes. In addition to providing mechanisms to ensure the security of information, is primordial allow users to choose whether to share data or not. Some companies offer benefits to incentive customers to share these data.

One of the biggest security holes that we find nowadays in the market is that each sensor or electronic device connected to the internet has their own holes or security issues. Imagine manage and assure security in a company with hundreds of sensors connected to internet. All devices need to be updated frequently to keep it safe. How to do it with a wide range of manufacturers and device types? We use our Rosetta Stone Gateway as a proxy gateway, forcing all devices authenticate with RS Gateway first, that will proceed with a secure handshake to confirm if it comes from the real device. When it is true, the device can access to internet only through RS Gateway. No one from outside can access RS gateway or any device inside network.

The same authentication process happens between Rosetta Stone Gateway and ALIGER Cloud. But in this case, it is done using cryptography key. As soon authentication is confirmed, a cryptography based security tunnel is established between ALIGER Cloud and each Rosetta stone Gateway. Still there a layer for transaction control. This feature

assures that the data originated came from right sensor and data content is authentic and was not changed or corrupted on the way to the cloud. It also assures that priority data arrives on the ALIGER Cloud first, without delays that could compromise data analysis or critical responses. We are planning to use OWASP baseline and best practices to drive our technology

Regarding to devices identification, all devices must have a unique identification number in the internet (UUID or MAC address). All members of this closed network must acknowledge that the device is really its. Therefore, we need to authenticate the device on the Rosetta Stone Gateway and the cloud to assure that the data collected have the right source.

In the ALIGER project we will improve security features, evaluating protocols in real life applications to assure that consumers will have all information safe. Open Data Institute will help us to improve it and certifying our security, integrity and data governance, issue us a certification of best practices and compliance with it standards.

(5) ROSETTA STONE GATEWAY:

In our first prototype, we developed a proprietary IoT gateway. It worked fine, but hi cost of each unit would be very difficult to manufacture it around the world and complicated to replicate it. So, we tried some open platforms based in microcontrollers and microprocessors. Among all that we have tested, The Raspberry PI model 3 was undoubtable the best option. For a market cost, lower than $35 for the board added with an open software version of our software, we could have the best open platform to replicate it around the world for a lower cost. Even adding some parts as plastic case, power supply, memory card and any USB dongle for specific wireless nonstandard interface, it still the lowest cost to enable any home, building or even business have at least one unit.

On the cloud, our “ALIGER Artificial Awareness Cloud platform” can be used by consumers worldwide through internet. Anyplace that consumers can buy an open hardware platform based in Raspberry Pi, just download our Rosetta Stone Gateway open software from web (our github open software repository), install it on Raspberry Pi add accessories and Rosetta Stone Gateway is ready to be configured.

First install sensors and other devices, connect all of them to Rosetta Stone Gateway, then register the gateway at ALIGER cloud platform and it is ready to use. Consumers can do it by themselves using our step by step video library community support, or hire some local certified specialist to implement complete solution for a service fee, or even buy products, sensors and other parts from them. And thus, creating new opportunities for unemployed people provide services, new startups or small business companies, bringing social benefits, jobs and knowledge for local community.

When a new powerful hardware is demanded to implement new features to Rosetta Stone Gateway, consumers just need to buy an updated model of raspberry pi or other open standard hardware homologated to work as new RS gateway. We are very worried in how to discard old electronics devices in a sustainable way. Preaching the recycle concept of re-purpose (find a new use for an outdated device), customers can donate raspberry pi old gateway hardware and sensors to any school. It will be used satisfactorily to teach kids to learn to code, as well a good introduce to electronics development. This attitude will directly contribute to increase of interest in STEM (Science, Technology, Engineering& Mathematics) training.

We are certain that we reached the best cost benefit factor to enable many consumers to take advantage of day by day automation features, preserve environment, save costs, raise awareness and educate consumers, gain efficiency, connect securely with a wide range of market available sensors and meters. We will offer a preemptive open environment smart platform to get a better quality of life, delegating to technology the tasks that computer does better than us to focus in what is most important.

(6) COGNITIVE INTERFACES:

Cognitive science, is the interdisciplinary scientific investigation of the mind and intelligence. It encompasses the ideas and methods of psychology, linguistics, philosophy, computer science, artificial intelligence (AI), neuroscience, and anthropology. The term *cognition*, as used by cognitivescientists, refers to many kinds of thinking, including those involved in perception, problem solving, learning, decision making, language use, and emotional experience.

Cognitive computing is the simulation of human thought processes in a computerized model. Cognitive computing involves self-learning systems that use data mining, pattern recognition and natural language processing to mimic the way the human brain works.

With technology advance of the contemporaneity age, the increase of computer power capacity and decrease of electronics components costs, has become new applications and getting decreased costs. Nowadays we usually carry in our pocket a smartphone with many times the computational capacity that was necessary to take the man to the moon. Instead of learning the language of the computers, they learned ours. Its cognitive interfaces enable us to give and receive commands by voice and use cameras as presence sensors, counting people, recognizing shapes and patterns, among other unthinkable applications until then.

In ALIGER project, we intend to develop program interfaces, called APIs, to connect ALIGER Artificial Awareness platform through Rosetta Stone Gateway to many consumer class voice human interface like: Amazon Alexa, Apple Siri, Google personal assistance and others. We also intend to connect our platform to IBM Watson to learn what kind of features and services we can offer to the market in the future with this partnership.

(7) STANDARDS, PLATFORMS AND ARCHITECTURES:

The greatest difficulty in getting devices to talk to one another is the lack of a common language. Today there are a myriad of versions of protocols, platforms and electronics that are incompatible. This lack of standard prevents the information collected in the sensors at the border being used properly for decision making, being the greatest obstacle in the adoption of new technologies.

Rosetta Stone Gateway will act as a local translator between all standards, protocols, platforms, electronics and wireless technologies. The core of ALIGER platform will be enforced with FIWARE adoption. It is a middleware platform, driven by the European Union, for the development and global deployment of applications for Future Internet. The API specification of FIWARE is open and royalty-free, where the involvement of users and developers is critical for this platform to become a standard and reusable

solution. The objective of FIWARE is to facilitate a *cost-effective creation and delivery of Future Internet applications and services* in a variety of areas, including smart cities, sustainable transport, logistics, renewable energy, and environmental sustainability.

Regarding to electronics and hardware based translations, we researched a lot of wireless dongle devices that can be connected to Raspberry Pi USB interfaces, enabling gateway to connect to other technologies, as GPRS, 4G, Zigbee, Zwave, LoRa and more. Sometimes we will need to develop a specific electronic interface such as Modbus to connect RS Gateway to building automation systems as HVAC System and other devices that are not available yet in the market.

To enable wide compatibility of Rosetta Stone Gateway, we also need to create some program interfaces (APIs) to connect with other standards, such as: Openhab, Open energy and more. It will enable ALIGER platform, as well Rosetta Stone Gateway to talk with legacy devices on the customer premises, preserving past investments and connecting all devices with integrity, independent of manufacturer.

One of our strategies is to make the Rosetta stone gateway a standard IoT software-defined platform that is securely updated over the Internet, that can add new interfaces and standards, be they software or hardware, as they become available in the marketplace to preserve the investment for the longest term possible, and facilitate the replication of technology to serve more customers.

(8) APPLICATIONS & SMART SENSORS:

In this project, we will have 3 types of sensors: 1 – Marketplace ready sensors; 2 – Legacy sensors; and 3 – Sensors that we need to build. Some of these sensors are only meters, but most of them work as actuators also, enabling turn on or turn off the device or flow when commanded by ALIGER platform. With this features we can automate most important tasks, as well collect information to platform learn and take decisions. Using a wide range of sensors, we will monitor all environment and homologate many applications use.

Smart AC outlets will collect data from energy consumption of connected device, as well energy quality, ground fault and other data, as well turning on or off the device connected. Low cost water flow control/meter device will enable system to read how

many liters or gallons of water are spent in a tap or in a shower, interrupting the flow when the goal is achieved.

Thermometer devices are available, acting as a sensor, but using light sensor and supporting high and low temperatures to be used inside refrigerators, generating data that could be correlated to other sensors to discover if consumer left the door open for too many time or by placing a hot pan in the refrigerator, which significantly reduces its efficiency and increases energy consumption. This type of sensor is also known as behavioral sensor when its data are correlated with others such as considering the external temperature informed by the climate service partners to help ALIGER platform make the best decisions and recommendation.

CO_2 Meters, Smoke and fire detectors also will be used to gather data, as well hi power on/off actuator to work with pumps and energy demanding devices, letting it works only when system need it. Using smart light devices available in the market we can turn on or turn off light as crepuscular lighting systems, control it remotely and even save energy, keeping turned on only lights with people into the premises.

If architecture is to become truly green, then a revolution of form and content including radical changes in the entire look of architecture—is essential. ALIGER platform will be ready for this challenge. This can only happen if those involved in the building arts create a fundamentally new language that is more contextually integrative, socially responsive, functionally ethical, and visually germane. The potentialities of environmental science and technology must be creatively examined. Already there exists a rich reservoir of ideas from science and nature—cybernetics, virtual reality, biochemistry, hydrology, geology, and cosmology, to mention a few. Furthermore, just as the Industrial Revolution once generated change in many fields in the 19th century, so too the information revolution, with its model of integrated systems, serves as a conceptual model in the 21st century for a new approach to architecture and design in the broader environment.

We are proud to let ALIGER Platform ready for this new field. We will test level tanks sensors, water quality sensors for reservoirs and ponds. We can monitor and manage water reuse and sewage systems, assuring the expected result before the resource be used or even discard. Our platform is also ready for water irrigation calculation formula, according to each region climate, quality of soil, likewise crop origin tracking for

premium agriculture or greenhouse management. We also intend to treat weight and measure the quantity of disposable trash as well material to be recyclable.

We expect generate a wide and diversity of qualified data to test our platform in all expected fields of IoT and applications, so we will have the maturity demanded from the market to became the base technology to worldwide innovative digital business module, delivering high value to consumers, make them happier and living better.

(9) CUSTOMERS AND PARTNER ECOSYSTEM:

There seems to be a significant shift in recent years in strategic thinking about why and when a technology company should consider building or joining an ecosystem, that is, a network of partners, third party vendors, evangelists, and plug-ins providers that revolve around the company's core technologies and product offerings independent of geographic region.

Good examples are the fast-growing ecosystems that have risen around tech darlings such as Twitter and Pinterest. These have contributed to the increased prominence of ecosystem development in startup strategy development. Having a clear ecosystem development strategy has become an essential part of the growth plan at a much earlier stage in a company's lifecycle.

We are planning a wide range of partners, including supply climate information companies to our platform. There are a lot of free of charge climate data bases on the web such as HAM from radio amateur groups or even weather stations self-installed by hobbyists. In some applications such as agriculture, our AI platform needs reliable climate information about many regions in the globe to take right decision and best recommendation.

Industries, customer with data subscription (according to our digital business model to be developed), Consumer associations, Academia, research institutes and many other companies would be able to access our data considering many levels of detail and availability. Application Program Interfaces, APIs will be also available according to partnership established. These tools will be certified to work with reliability, confidence and security.

(10) TRIAL OF FUTURE DEVELOPMENTS ON THE FIELD:

In ALIGER project, we intend to trial some new innovative fields, such as human interfaces, features and devices to improve our platform. We relate below some of these future deployments and applications that will be tested:

A - Computer vision, Field of robotics in which programs attempt to identify objects represented in digitized images provided by video cameras, thus enabling robots to "see." Much work has been done on stereo vision as an aid to object identification and location within a three-dimensional field of view. Recognition of objects in real time, as would be needed for active robots in complex environments, usually requires computing power beyond the capabilities of present-day technology. In this area, we intend to finish the development of a behavior camera, able to recognize standards, behaviors, learn new applications.

Nowadays CCD camera sensors are too cheap, enabling the use of cameras to act smartly than an optical sensor with wider features. One of the applications of this camera could be identify products at supermarket shelf, count it, see if it is the right brand on the place, or even in a refrigerator display. It will not be an video analytics product that already have a lot of options in the marketplace, but a small and lower cost camera to be used in IoT developments and applications with the benefits of computer vision and AI technologies developed.

B - In the healthcare devices and sensors field, we will focus in some smart assisted living and well-being applications. We do not intend to develop any healthcare sensor, but acquire some from EU companies that became reference in this area. These eHealth Medical Development platform, reliable and certified, will include these sensors installed in few consumer premises, to enable real life experiences with data generated from SPO2 oximeter, ECG Electrocardiogram, Airflow breathing, Blood pressure, Glucometer, Body temperature, EMG Electromyography, Spirometer air capacity, GSR Galvanic skin response, Body position Sensor, Body scale and fall/acceleration/ emergency devices. All of them connected to Rosetta Stone Gateway.

C - Food management: Some devices will be tested in real life to assure that it will be helpful to customers. One of them is a low-cost barcode reader to register all foods and

goods that will be stored in the larder, as well register the food or goods consumed and validity, thus allowing automatic replenishment of food and goods. Inside larder, we will test an IoT button to be pressed anytime we need to replace a good. All products to be replaced could be automatically ordered from the store once a week to avoid lack of supplies. With a small printer or other available at consumer premises, labels could be printed to control the validity of supply, including frozen food. Our AI system will be used to suggest the use of all food and supplies before the end of validity and consequently mitigating waste. Another aspect of this application is compare the price of item supply on the web to recommend the store of lower cost and process the order automatically in the right frequency, if it is authorized by the consumer.

D – Vermicomposting, green house and garden automation. It includes vermicomposting boxes box for organic waste recycle with sensors and low cost irrigation system. With these applications, we intend to research the best algorithm and sensors to improve organic recycling and best method to calculate watering plant, as well the correct wavelength to develop a garden, even for places without incident of sun.

(11) CONSUMER MERITOCRACY & GAMIFICATION SYSTEM:

How to promote team engagement in a digital environment that responds to the challenges of the new economy? How we can enforce our Knowledge Management plan to assure consumer behavior change for an environment responsible model?

Some researchers believe that the ideal is intrinsic motivation, understood in a very demanding way. Fair equality of opportunity obtains in a society when all persons with the same native talent (genetic inheritance) and the same degree of ambition have the same prospects for success in all competitions for positions that confer special economic and social advantages.

In the ALIGER project, we believe that we can answer these questions by implementing the concept of meritocracy, complemented by gaming technologies, with the ability to classify consumers according to the adoption of sustainable practices and the actions to diffuse these practices with the use of our platform.

Regarding to electronic games, this technology moved into the mainstream of commerce and culture around the world, developers of electronic games explored social networks as a new platform, incorporated technologies that reworked the interactive and immersive aspects of game play, and applied game mechanics to many other fields of activity. The importance of virtual communities for online games emerged from the relatively closed worlds.

The cultural impact of electronic games throughout the world in the early 21st century was undeniable, paced by trends such as the growth and acceptance of game art. The "Serious Games" movement, which sought to integrate elements of electronic gaming into education and training. Gamification became the technology to the application of game mechanics to virtually any field of endeavor.

Interactive research, an overall approach to knowledge and inquiry, concerned with forging a direct link between intellectual knowledge and moment-to-moment personal and social action. Our interactive research system seeks to contribute directly to the flourishing of individuals, their communities, and the ecosystems of which they are part. this research has two faces: one is practical, concerned with providing processes of inquiry that are useful to people in the everyday conduct of their lives; the other is philosophical and political, part of a movement to ensure that what is taken as knowledge is philosophically sound, participatory, and pragmatic.

Our interactive research practices aim to open communicative spaces where people can come together in open dialogue to address issues of concern and to engage in cycles of action, reflection and behavior change, so that ideas that are tentatively articulated in reflection can be examined systematically in phases of active experimentation.

b) METHODOLOGY

During the project the consortium will:

- Monitor households consumption habits of at least 40 households (20 in Brazil and 20 in EU).
- This that correspond to different profiles (location, size of dwelling, number of family members, age, etc.);

- Define consumer profiles when the effective behavioural change triggers and the real energy efficiency potential in the households, the consumption of resources like water and gas and if the technological aspect are really implemented as a new family process;
- Follow the users along the process, in order to understand the difficulties in the adoption process and motivate the users;
- Develop the necessary innovative changes in the smart hub and in the ALIGER Artificial Awereness Cloud Platform, allowing the best data management.
- Define the communication to motivate end-users to adopt efficiency measures and to promote the IoT logical to the general public, tailored communication and dissemination to the target groups will be created;
- Create open standards that allow any other devices, sensors or apps that will came in the future to add to the platform;
- To foster the development and production of more efficient household appliance due to the comparison of the real operation and efficiency based between different characteristics of consumer.

2.4 AMBITION

We are building an ecosystem of partners being able to integrate solutions, softwares and technologies using APIs, protocols and standard interfaces expanding the value propositions of the platform. Further, it will be increasingly harder for new competitors and the platform will be the reference for the markets of the offered services.

Furthermore, the project generates and manages a big data system as a source for consumer protection organizations making them able to run new evaluation methods of electrical devices. This big data system can also be used by manufacturers in order to improve their products or to create new markets.

Nowadays, we have several products for home automation, (e.g. Google Home, Amazon Echo and Home Kit) but they do not present equipment or software that combines the functionalities and features of our platform. It is inevitable that other competitors also arrive where we want to be, is a trend of technology, so it is extremely

important to invest all the resources to reach the market first and win the customer base before the other competitors.

The main company doing something similar in Europe is Smapee. Simple and cheap device developed in the European community that measures electricity, gas and water consumption and learns the behavior of each device connected to the grid, it is connected to the electrical board through a single current transformer and when it perceives an increase of immediate consumption, ask to the user what it is, and its being the user's responsibility to inform him which equipment was triggered and answered by that peak of consumption. In this way he will know how much that device consumes. NILM technology is used and to increase the accuracy of measurements, low-cost consumption measurement sockets are used. It can be bought in Europe for 230 euros the meter and an outlet. It has no home automation capabilities, no cloud service with features beyond franking connectivity to users to view consumption and respective reports.

Another important competitive advantage of our platform is that we will use the best features from Google, Apple and Amazon, in addition to others, to make our offer the most complete on the market, giving and receiving voice commands as well as recommendations. Regardless of the platform, product, technology or operating system the user has, consolidating all the information collected and managed on a single basis that will bring together all machine-to-machine communication protocols until a standard is established.

None of the competitors have the same business model as ours which, in addition to marketing a hub and several sensors, also contemplates using the information collected to generate other business.

Moreover, the solutions found are closed between partnerships between manufacturers and do not have an interaction to different brands of products. Our platform will not be limited to some brands, but it will have the ability to monitor and automate different products of different makes and models.

Certainly, according to the time and the market demand, some of them will have technologies similar to ours, but at the moment they are nonexistent.

Our technology platform will be cloud-based and based on the internet concept of things for residential and commercial use. The proposal is the installation of a hub, type "IoT Smart hub", based on communication protocols and standard addressable sensors, aiming to promote the interoperability of applications and sensors.

Based on information collected by the platform, through sensors in the local environment, in the network, and using intelligent algorithms, we will have data that will provide fundamental statistical information for decision making and support of the competitive advantage for our partners, as well as the empowerment and awareness of good use of equipment and natural resources.

Relevant and proprietary information will be made available securely in a private cloud with limited partner access, while anonymous information will be made available in accordance with Open Data Institute guidelines to foster the creation of an ecosystem of complementary businesses, opportunities and businesses.

3. IMPACT

3.1 EXPECTED IMPACTS

We have identified several stakeholders that will be impacted, as cited below:

a) Consumers: showing their own habits use appliances and energy it will encourage them to change their habits and products aiming to save money and to reduce natural resources wasting;
b) Appliance industries: getting information on usability of their products, user's habit and comparability studies with competitors they will be able to provide better products, better target their R&D and marketing resources;
c) Retail stores: getting information on products they sell and about consumers' habits they can better choose their product mix, better target their marketing resources and help consumers choosing products suitable to their profile;
d) Sensors manufacturers: business opportunities will be expanded and they will be enpowered to create new sensors for new data and prospect new business models;
e) Data Analytics and Artifical Intelligence services: improve quality information to end-user;
f) Public policy makers: they will get reliable information about use of energy to confirm, revise and create new laws and regulations;

g) Public administrators: with information on geolocalized energy consumption they can plan and meet public demands on energy, gains efficiency, meet local and global expectations of efficient energy management;

h) Consumer protection organizations: one of the main objectives of the consumer organizations is to test products and provide the best choice to the consumer, by the comparison of results. Usually, the consumer organizations go to the market, to buy products, like anyone else, and send that to specializes laboratories. They test under controlled protocols and standards. After the results, the consumer association compare the results and publish it on their own magazine, website and social networks. The results, when we discovered some irregularity or nonconformity, are also forward to responsible government agency to verify with the companies or change the legislation. One concern about comparative test is, even with the precision of the test inside excellent laboratories, the results cannot be estimated to different kind of consumer behavior. For example: today, in Brazil, the official test for refrigerators efficiency (exposed in Label Efficiency on the stores) is done without open door process. In other words, the behavior of consumer are not taking account. Even when we simulate that action on test, we are not facing the diversity of weather, that can variate from region to region, due to the Brazilian dimension, and it can influence on the comportment of each household appliance. In Europe, the efficiency label follow the same rules, even for different countries, different characteristics, and peculiarity, that can have influence on the product behavior. The habits between different cultures is easily identificate and the need of an singular choice is required, especially if we take into account that the products produced in Europe are marketed between several countries. After the project implementation, the consumer organization will be able to compare, the laboratory measure and the real measure, to suggest the best product specifically to each different family, taking account their habits and needs as a consumer. Due to the implementation of the project, it will allow the access to the data of the consumer behavior, the product behavior and the relation between both.

3.2 MEASURES TO MAXIMISE IMPACT

a) DISSEMINATION AND EXPLOITATION OF RESULTS

The app to introduce to the participants will have a phased released, Adroid first, and IOS second. This technical implementation will be part of WP3 while the communication to existing users is part of WP4.Explanations will be provided as well as the possibility to be linked and share information with consumer associations.

Similar technologies are present in all European countries. Therefore, the reach of the project is beyond the mere target countries.

Dissemination of the results to the scientific world. Thanks to the University of Paris Sud in France, HochschuleRheinMain University in Germany and more 3 universities in Brazil (UFRJ, UFPE and UFMT), the consortium will manage to collate and gather very relevant interesting outputs for the scientific world. After previous agreements of the partners, the Universities can freely publish the results. Those Universities will also participates in conference, symposia etc.

Communication to key future users. Consumer associations will engage massively in communicating and in enrolling campaigns. After validation of the results (showing a true gain for consumers), consumer organisations are planning to launch collective actions to promote the tools and their applications:

- Articles in consumer associations magazines (reach over 1.4 Million consumers)
- Articles and dossiers in consumer associations' websites (with over 65 million visits a year)
- Information and results in newsletters (at least 1 per year per country)
- Engaging in social media (Facebook, twitter, YouTube… to promote the results)
- Press releases to promote the collective action

b) COMMUNICATION ACTIVITIES

Objectives: communicate to stakeholders the progress of the pilot implementation and, in the WP5 (Work Package 5), communicate to new customers according with the data collected by sensors.

For Brazil:

Table 1: Communication activities for Brazil

Target audience	Objectives	Measures
Consumers	Broad communication to consumers to increase awareness and knowledge preparing the ground for dissemination of this technological approach	Consumers' defender institutes will use their communication capabilities to communicate to consumers. This task should be priority online, due to the nature of the technology and who is more interested. Thatwillhappen via: ● Their websites (Specific area on the web site for the project, with information updated) ● Their newsletters (interesting findings will be valorised in newsletters sent to members of consumers' institutes) ● Fan Pages posts to large public (with boosted posts) ● Videos showing all steps of the project. Since de management, the production, the distributing and testimonials from the users to promote the initiative ● Press releases of interesting results
Stakeholders	Spreading the results. Supporting the promotion	The results can be presented by consumers' defender institutes, the academicals and innovation institutes promoting the solutions on the energy management and technologies of IoT.

4. IMPLEMENTATION

4.1 WORK PLAN —WORK PACKAGES, DELIVERABLES

The project is divided into five Work packages. Each work package represents a key working area. The Structure of work is represented bellow with the **Figure 2** and the schedule of the implementation in the **Table 2**.

WP1 is the management work package. Meetings, management activities, reporting, buddying etc…will be part of this work package.

WP2 title is Intelligence development: This work package will start with the WP3, but it will be kept until the end of project, because this WP is related to the Artificial intelligence, the software improvements and pivotations, the development of the app as the interface with the consumer that includes the gamification logic, the standardizations between all the protocols already used and adjusting the tool of platform in accordance with the Brazilian and European needs. Thar work programme will feed WP4 and WP5 during all the project.

WP3 tittle is Building the pilot. This WP will work at the same time with the WP2 and should have strict connection. This phase includes the acquisition of all components, the assembly, test of functionality and validation.

WP4 is the Application on field. That's the WP of the implementation on the consumer residences, that the consumer organizations are committed to monitor residences, being with our smart hub. The families will receive the devices free of charge and Aliger local distributors will support the installation.

Series of qualitative and quantities tests will be carried out during the Application phase.

WP 5 is called Collecting and using of data. It's an very important phase that will show us if the platform are been correctly used by consumers, if the changing of behaviour is really happening in the daily life of consumers, if the tool need any pivotation, related to to WP2, also carrying out the analysis and the report of the project outcomes learning

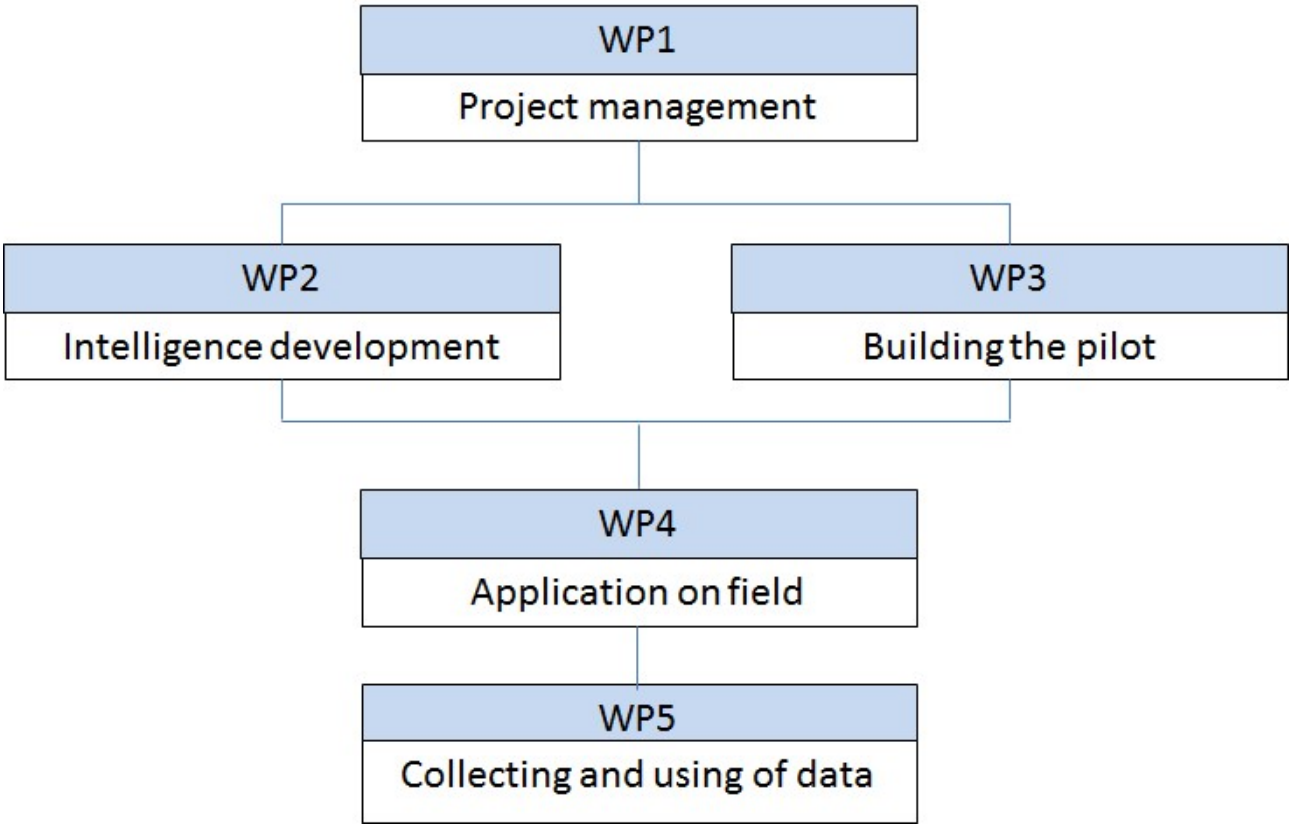

Figure 2: Work Packages Scheme

Table 2: Schedule for implementation of Work Packages

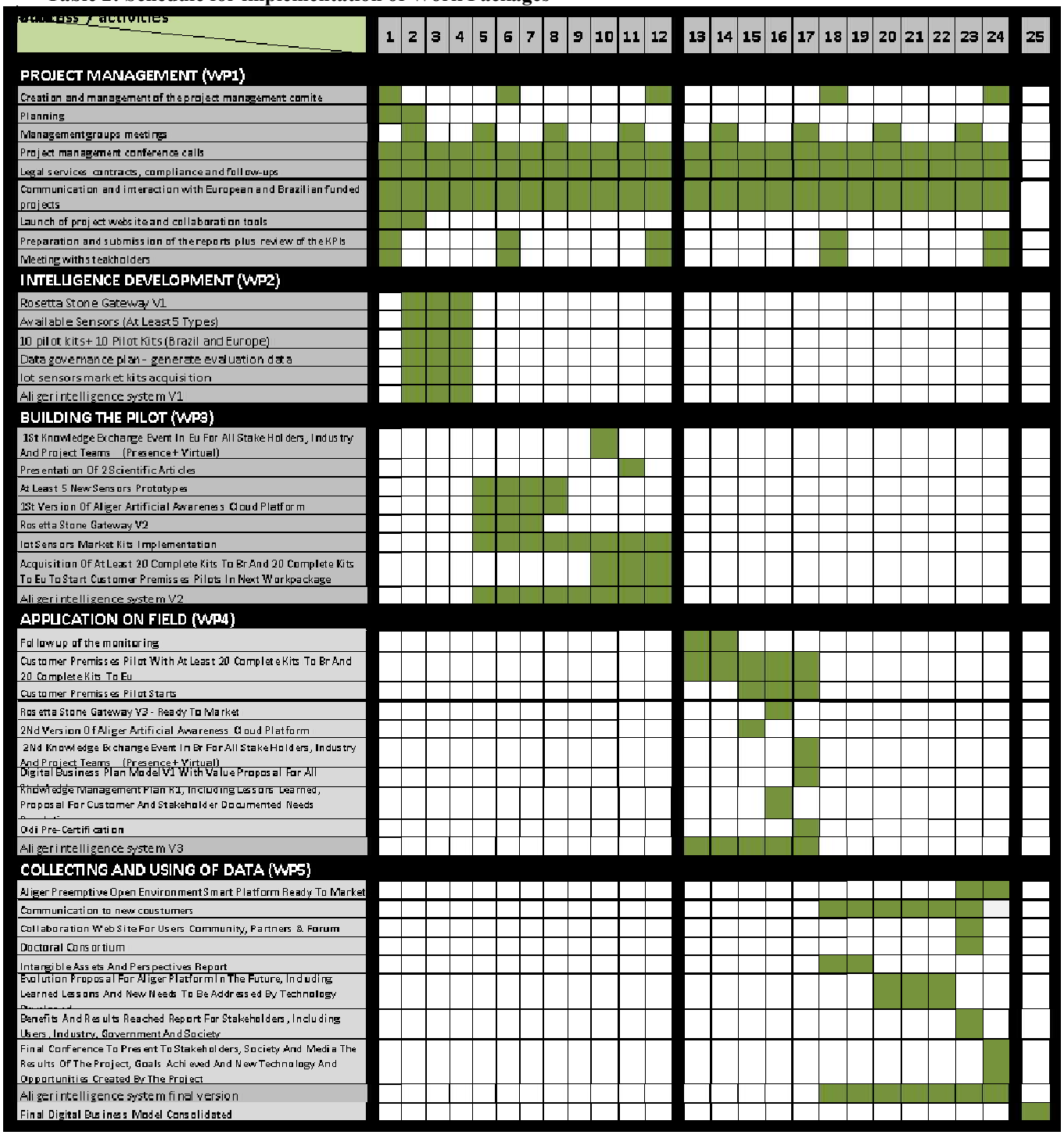

Table 3: Work package 1 - Project Management

Workpackagenumber	1	**Lead Beneficiary**						Coppe/UFRJ		
Workpackagetitle		Project Management								
Participantnumber	1	2	3	4	5	6	7	8	9	10
Short nameofparticipant	PT	UFPE	UFMT	AL	CP	TA	ISI	AE	HS	UPS
Start month	1			Endmonth	24					

Objectives

WP 1 is a summary of all the important stages involved in the coordination, exchange of information and success of the project. The consortium will start with a physical "Management Meetings" and will repeat once a year, due to the transfer high cost, but video conferences/conference calls in between to maintain good communication between the project meetings. Locally, in Europe and Brazil, the meeting require to be presential each 6 months.

The quality of the work and of the results are going to be reviewed and ensured by the work package leaders and the coordinator. The management committee will in fact meet half a day before each management meeting to assure the quality of the deliverables and the respect of the deadlines.

The performance indicators will be reviewed at each management meeting and shared with the European Commission and RNP project officer.

Contract a collaboration tool for project team communication, documents and work flow control.

Description of work

Task 1 - Creation and management of the Project Management Committee (task leader: COPPE/UFRJ)

The consortium will have a Project Management Committee. They will be in charge of the deliverables of each work package (making sure it is of good quality and completed on time).

The project management committee will be also in charge of the innovation and Knowledge Management.

Task 2 - Management meetings (task leader: COPPE/UFRJ)

The members of the consortium (plus external experts if needed) will meet each month during the life of the project. These meetings will be used to exchange information, work together, evaluate progress and review any difficulties. Steering decisions will be taken during these plenary meetings to make sure timings are met and deliverables are progressing as they should.

Organisation of the kick-off meeting and of the final meeting wherein a maximum of 2 participants per consortium member and stakeholders will participate.

Task 3 - Project management conference calls (task leader: COPPE / UFRJ)

Regular conference calls will be organised to share information and have technical discussions on the different work packages and sub-work packages (24 video conferences planned during project life).

Task 4 - Meeting with stakeholders (task leader: COPPE / UFRJ)

Several meetings with stakeholders at European and National level will be organized.

Task 5 - Preparation and submission of the reports plus review of the KPIs (task leader: COPPE / UFRJ)

At each plenary meeting the main KPIs and KPAs (Key Performance Actions: output and deliverables) will be reviewed. All information will be provided in each work package report, as well could be accessed anytime at project management web site.

Task 6 - Buddying partners (task leader: COPPE / UFRJ)

Several hours will be spent mentoring and supporting teams. We should not forget that one of the outputs of the project is to remove the non-technological barriers by raising awareness, encouraging exchange of experience and know-how, and sharing best practice and the best available technologies as described in our Knowledge Management Plan. The members of the consortium will get stronger, thanks to the international collaboration tools and events to integrate teams and the support of the other members.

Role of the Participants:

Coppe / UFRJ is the leader of the consortium in Brazil and has a project manager role. It will be the main contact point for all project stakeholders. It will be in charge of most of the WP tasks.

Deliverables (brief description and month of delivery)

- **Creation and management of the project management comitee**
- **Planning**
- **Management groups meetings**
- **Project management conferencecalls**
- **Legal services contracts, compliance and follow-ups**
- **Communication and interaction with European and Brazilian funded projects**
- **Launch of project website and collaboration tools**
- **Preparation and submission of the reports plus review of the KPIs**
- **Meetingwithsteakholders**
- Collaborative tool for project team

Table 4: Work package 2 - Intelligence development

Workpackagenumber	2	**Lead Beneficiary**				ALIGER	
Workpackagetitle		Technical development, artificial intelligence and deep learning algorithms					
Participantnumber	1	2	3	4	5	6	7
Short nameofparticipant	PT	TA	UFPE	UFMT	ALIGER	CP	ODI
Start month	2			Endmonth	5		

Objectives

- Validate platform data acquisition, flow and storage
- Establish the interoperability of devices, the IoT architecture, the cloud storage.
- Define a data governanceplan
- Collect initial data for analytics

- Create a product web site
- Create a communityforum

WP2 has the aim to:

- Create an IoT environment able to connect all the devices in the residence to the API of the platform. Using the Fiware, we decide to follow standards define by the architecture (e.g. HTTP, REST, API, ETSI, MQTT and IETF). We also will use the authentications and data models defined by Fiware.
- Build the application focused on customer experience by developing engaging tools by gamification, supporting behavioural change, including kids and adults.
- Develop the intelligence of the platform to work independently of each smart hub, to process the data on cloud and returns with the feedback and triggers to consumer, with regional markets analyses.
- Make the tool available in, at least, four languages: Portuguese, Italian, French and English. (appandinstructionmanuals)
- Ensure all the safeties protocols on the market, that will ensure that the open data provide will not violate the privacy of users.

The development iterations will create several versions of the tool.

Description of work

Rosetta Gateway collecting data to cloud servers - version 1 to connect the basic set of sensors and sent data to ALIGER Artificial Awareness Cloud Platform data storage. The goal is data flow validation of platform technology stack, gateway, secure connection, data acquisition API, data processing and storage.

Gateway connects to basic set of sensors - at least 5 sensors, one of each area of interest of H2020 scope. The goal is to test sensors that will be part of kits distributed to pilot clients, sensors connection to gateway and create data for analytics and machine learning algorithms.

Data governance plan - generate a plan of best practices to data privacy, security and availability.

Product web site for manual and how to - create a repository of documents, manuals, and howtos to clients.

Community forum - for knowledge management and support for clients.

Deliverables (brief description and month of delivery)

- **Rosetta Stone Gateway V1**
- **Available Sensors (At Least 5 Types)**
- **10 pilot kits + 10 Pilot Kits (Brazil and Europe)**
- **Data governance plan - generate evaluation data**
- **Iotsensorsmarket kits acquisition**
- **Product web site**
- Communication to new costumers
- Collaboration Web Site For Users Community, Partners & Forum

Table 5: Work package 3 - Building the pilot

Workpackagenumber	3	**Lead Beneficiary**				ALIGER	
Workpackagetitle	Building the pilot with all devices						
Participantnumber	1	2	3	4	5	6	7	8
Short nameofparticipant	PT	TA	UFPE	UFMT	AL	CP	ODI	ISI
Start month	5			Endmonth	12			

Objectives

The WP3 have the role to build the physical part of the platform:

- Create the final structure of the smart hub
- Use components that can be upgradable for the case in, after the project, install other applicabilities, as domotica and automation.
- Ensure that the rules for Brazil and Europe are being followed (i.g. certification of the outlets)
- Foment the local manufactories in the areas required on the Brazilian side of the Call.
- Development of the artificial intelligence, predictive algorithms and deep learn processes.

After the 24 months, the WP3 will maintain an small team to follow the WP4 and give support when it's needed.

The development iterations will create several versions of the tool.

Description of work

- Data monitoring - allow clients to set alerts for measures and consumption goals, enabling them to improve resource usage management.

- At least 5 new sensors and their data reports - addition of an improved set of sensors for all H2020 areas of interest.

- Data analysis reports and advices - bring back to decision takers the analysis and advices as result of ALIGER Artificial Awareness Cloud processing

- Sensor state change for remote management - allow clients to remote manage the devices that allow a change in current operational state(lamps, AC, water flow).

Deliverables (brief description and month of delivery)

1. 1St Knowledge Exchange Event In EU For All Stake Holders, Industry And Project Teams (Presence + Virtual)
2. Presentation Of 2 Scientific Articles
3. At Least 5 New Sensors Prototypes
4. 1St Version Of ALIGER Artificial Awareness Cloud Platform
5. Rosetta Stone Gateway V2
6. Iot Sensors Market Kits Implementation
7. Acquisition Of At Least 20 Complete Kits To Br And 20 Complete Kits To Eu To Start Customer Premisses Pilots In Next Workpackage
8. ALIGER intelligence system V1~~2~~

Table 6: Work package 4 - Application on field

Work package number	4	**Lead Beneficiary**				PT and TA	
Work package title		Application on field					
Participant number	1	2	3	4	5	6	
Short name of participant	PT	TA	AE	AL	CP	ISI	
Start month	13			End month	17		

Objectives

This WP will focus on delivery and install the smart hub and sensors at consumers residences. That will be in Europe and Brazil at the same time, but with separated schedules fitting the needs of each side of consortium.

The consumer organizations must guarantee the profile of consumer selected on field. All the installing process must to be followed by, at least, two professionals, one from Consumer organization, and other designated by ALIGER.

All the hardware will be built in Brazil and must to be sent with all requirements of European Commission to access the market without pendency, avoiding any import or customs problems.

In this WP all difficulties will be reported by the professionals designated, to suggest the necessary adjustments as soon as possible to the working group.

Description of work

- Data monitoring - alerts for consumption tendency and purpose actions.

- Platform geographic distribution for low latency - replicate the platform structure in EU and BR datacenters and perform data integration for high availability and performance scenarios, and data

integration for large ammount of sensors.

- Open data platform endpoints - Disposal of open data API endpoints for data sharing.

- Automatic sensor control for resource saving - allow the ALIGER Artificial Awareness Cloud to take actions for resource saving.

Deliverables (brief description and month of delivery)

- Follow up of the monitoring
- Customer Premises Pilot With At Least 20 Complete Kits To Br And 20 Complete Kits To EU
- Customer Premises Pilot Starts
- Rosetta Stone Gateway V3 - Ready To Market
- 2Nd Version Of ALIGER Artificial Awareness Cloud Platform
- 2Nd Knowledge Exchange Event In Br For All Stake Holders, Industry And Project Teams (Presence + Virtual)
- Digital Business Plan Model V1 With Value Proposal For All Stakeholder
- Knowledge Management Plan R1, Including Lessons Learned, Proposal For Customer And Stakeholder Documented Needs Resolution.
- ODI Pre-Certification
- ALIGER intelligence system V2

Table 7: Work package 5 - Collecting and using data

Work package number	5			**Lead Beneficiary**		Coppe UFRJ			
Work package title		Collecting and use of data							
Participant number	1	2	3	4	5	6	7	8	9	10
Short name of participant	PT	TA	AE	Coppe	AL	ODI	UFPE	UFMT	HS	UPS
Start month	18			End month	25					

Objectives

This WP will focus on developing and providing the insights that will be communicated to the end-users by the creation of direct links between their real-life consumption situation and the expertise and counselling from Consumer Organizations.

This WP will have specifics work groups to care about:

- The curatorship of the information generated automatically by the platform,
- The information about the household appliance consumption, efficiency and, when applicable, durability.
- The definition between the profile of consumer identified and their real habits.
- To measure the impact of the implementation in the life of end user, taking account the saving of energy, money and the changing of their behavior.
- Identify the next steps to develop an Business Model to support the initiative after the project without loss to the consumer and to the consortium participants.

Description of work

- Platform availability tests and adjustments - perform the necessary adjustment to full production start

- Evaluate project goals, results, impacts and continuity.

- Create project final reports and meetings.

Deliverables (brief description and month of delivery)

- ALIGER Preemptive Open Environment Smart Platform Ready To Market
-
- Doctoral Consortium
- Intangible Assets And Perspectives Report
- Evolution Proposal For ALIGER Platform In The Future, Including Learned Lessons And

New Needs To Be Addressed By Technology Developed

- Benefits And Results Reached Report For Stakeholders, Including Users, Industry, Government And Society
- Final Conference To Present To Stakeholders, Society And Media The Results Of The Project, Goals Achieved And New Technology And Opportunities Created By The Project
- ALIGER intelligence system final version
- Final Digital Business Model Consolidated

4.2 MANAGEMENT STRUCTURE, MILESTONES AND PROCEDURES

Table 8: Deliverables Structure

Deliverable (number)	Deliverable name	Work package number	Short name of lead participant	Type	Dissemination level	Delivery date (in months)
D1.1	Creation and management of the project management committee	WP1	Coppe	R	CO	m1 , m6, m12, m18, m24
D1.2	Planning	WP1	Coppe	R	CO	m2
D1.3	Management groups meetings	WP1	UFPE	R	CO	m2, m5, m8, m11, m14, m17, m20, m23
D1.4	Project management conferencecalls	WP1	ALIGER	R	CO	m1 - m24

Deliverable (number)	Deliverable name	Work package number	Short name of lead participant	Type	Dissemination level	Delivery date (in months)
D1.5	Jurídico (contratos e acompanhamento)		PROTESTE	R	CO	m1 - m24
D1.6	Communication and interaction with European and Brazilian funded projects	WP1	PT and TA	R	PU	m1 - m24
D1.7	Launch of project website and collaboration tools	WP1	PT and TA	DEC	PU	m2
D1.8	Preparation and submission of the reports plus review of the KPIs	WP1	Coppe	R	CO	m1 , m6, m12, m18, m24
D1.9	Meeting with steakholders	WP1	ALIGER	R	CO	m1 , m6, m12, m18, m24
D2.1	Rosetta Stone Gateway V1	WP2	ALIGER	DEM	CO	m4

Deliverable (number)	Deliverable name	Work package number	Short name of lead participant	Type	Dissemination level	Delivery date (in months)
D2.2	Available Sensors (At Least 5 Types)	WP2	ALIGER	DEM	CO	m4
D2.3	Data governance plan - generate evaluation data	WP2	UFPE/UFMT	R	CO	m4
D2.4	Iot sensors market kits acquisition	WP2	ALIGER	DEM	CO	m4
D2.5	ALIGER intelligence system V1	WP2	ALIGER	R	CO	m4
D3.1	1St Knowledge Exchange Event In Eu For All Stake Holders, Industry And Project Teams (Presence + Virtual)	WP3	Coppe	R	PU	m10
D3.2	Presentation Of 2 Scientific Articles	WP3	Coppe/ UFPE/ UFMT	R	PU	m11

Deliverable (number)	Deliverable name	Work package number	Short name of lead participant	Type	Dissemination level	Delivery date (in months)
D3.3	At Least 5 New Sensors Prototypes	WP3	ALIGER	DEM	CO	m8
D3.4	1St Version Of ALIGER Artificial Awareness Cloud Platform	WP3	ALIGER	Other	CO	m8
D3.5	Rosetta Stone Gateway V2	WP3	ALIGER	DEM	CO	m7
D3.6	Iot Sensors Market Kits Implementation	WP3	PT / TA	DEM	PU	m12
D3.7	Acquisition Of At Least 20 Complete Kits To Br And 20 Complete Kits To Eu To Start Customer Premisses Pilots In Next Workpackage	WP3	ALIGER	R	CO	m12
D3.8	ALIGER intelligence	WP2	ALIGER	R	CO	m12

Deliverable (number)	Deliverable name	Work package number	Short name of lead participant	Type	Dissemination level	Delivery date (in months)
	system V1					
D4.1	Follow up of the monitoring	WP4	Coppe	R	CO	m14
D4.2	Customer Premisses Pilot With At Least 20 Complete Kits To Br And 20 Complete Kits To Eu	WP4	ALIGER	R	CO	m17
D4.3	Customer Premisses Pilot Starts	WP4	PT / TA	R	CO	m17
D4.4	Rosetta Stone Gateway V3 - Ready To Market	WP4	ALIGER	R	CO	m16
D4.5	2Nd Version Of ALIGER Artificial Awareness Cloud Platform	WP4	ALIGER/ UFPE/ UFMT	DEM	CO	m15
D4.6	2Nd Knowledge Exchange Event	WP4	Coppe	R	PU	m17

Deliverable (number)	Deliverable name	Work package number	Short name of lead participant	Type	Dissemination level	Delivery date (in months)
	In Br For All Stake Holders, Industry And Project Teams (Presence + Virtual)					
D4.7	Digital Business Plan Model V1 With Value Proposal For All Stakeholder	WP4	HS / UPS	R	CO	m17
D4.8	Knowledge Management Plan R1, Including Lessons Learned, Proposal For Customer And Stakeholder Documented Needs Resolution.	WP4	HS/ UPS	R	CO	m16
D4.9	ODI Pre-Certification	WP4	ODI	R	CO	m17
D4.10	ALIGER intelligence	WP2	ALIGER	R	CO	m17

Deliverable (number)	Deliverable name	Work package number	Short name of lead participant	Type	Dissemination level	Delivery date (in months)
	system V1					
D5.1	ALIGER Preemptive Open Environment Smart Platform Ready To Market	WP5	ALIGER	Other	CO	m24
D5.2	Communication to new coustumers	WP5	PT / TA	R	PU	m23
D5.3	Collaboration Web Site For Users Community, Partners & Forum	WP5	PT / TA	DEC	PU	m23
D5.4	Doctoral Consortium	WP5	Coppe	R	PU	m23
D5.5	Intangible Assets And Perspectives Report	WP5	HS/UPS	R	CO	m19
D5.6	Evolution Proposal For	WP5	HS/UPS	R	CO	m22

Deliverable (number)	Deliverable name	Work package number	Short name of lead participant	Type	Dissemination level	Delivery date (in months)
	ALIGER Platform In The Future, Including Learned Lessons And New Needs To Be Addressed By Technology Developed					
D5.7	Benefits And Results Reached Report For Stakeholders, Including Users, Industry, Government And Society	WP5	Coppe	R	PU	m23
D5.8	Final Conference To Present To Stakeholders, Society And Media The Results Of The Project, Goals Achieved And New Technology And Opportunities	WP5	Coppe	R	PU	m24

Deliverable (number)	Deliverable name	Work package number	Short name of lead participant	Type	Dissemination level	Delivery date (in months)
	Created By The Project					
D5.9	Final Digital Business Model Consolidated	WP5	Coppe	R	CO	m25

4.3 CONSORTIUM AS A WHOLE

The list of consortium and the summary of each whole as stakeholder and function are organized in the**Table 9**.

Table 9: Consortium table

NAME / DESCRIPTION	STAKEHOLDER	FUNCTION
COPPE/UFRJ - The institution for Graduate Studies and Research in Engineering at federal University of Rio de Janeiro (UFRJ)	Research institute	Enabled to receive and control the fund
UFPE – Federal University of Pernambuco (Brazil)	Research institute	Institute at the Sudene area responsible for the development of the software

NAME / DESCRIPTION	STAKEHOLDER	FUNCTION
UFMT – Federal University of Mato Grosso (Brazil)	Research institute	Institute at middle east area responsible for the development of the software
ISI – Instituto SENAI de Inovação	Research institute	Institute at the Sudene area, responsible for the assembly and production of the hardware
Wiesbaden University (Germany)	Research institute	Department focused on Knowledge management, and will be responsible for the use of the information generated in this project.
PROTESTE	Consumer Organization	260.000 members in Brazil, responsible for the implementation of kits at the residences.
ALIGER Indústria de Base Tecnológica Ltda. (Brazil)	Sensor manufacturer; Data Analytics and Artificial Intelligence services	Technology Company
ODI – The Open Data Institute	Organizations that support the open culture (data, source, knowledge,	The responsible for the curacy and protocols for the open data using

NAME / DESCRIPTION	STAKEHOLDER	FUNCTION
	innovation)	
Altroconsumo	Consumer Organization	350.000 members in Italy, responsible for the implementation of kits at the residences.
Test-Achats	Consumer Organization	Almost 1 Million members in Belgium, responsible for the implementation of kits at the residences.
Deco Proteste	Consumer Organization	400.000 members in Portugal, responsible for the implementation of kits at the residences.
OCU	Consumerorganization	350.00 members in Spain, responsible for the implementation of kits at the residences.
Paris Sud	Research institute	Department focused on Knowledge management, and will be responsible for the use of the information generated in this project.

3.3.1. CONSORTIUM MEMBERS OVERVIEW:

3.3.1.1 COPPE / UFRJ

http://www.coppe.ufrj.br/

http://www.coppetec.coppe.ufrj.br/site/

https://ufrj.br/

The Federal University of Rio de Janeiro or University of Brazil (Portuguese: *Universidade Federal do Rio de Janeiro*, UFRJ or *Universidade do Brasil*) is a public university in the state of Rio de Janeiro, Brazil. UFRJ is the largest federaluniversity in the country and is one of the Brazilian centers of excellence in teaching and research. In terms of scientific, artistic and cultural productions it is recognized nationally and internationally due to the great teachers, researchers, reviews and assessments made by international agencies. In 2015 *QS World University Rankings* ranked UFRJ as the best Brazilian federal university, as well as the third best university in the country occupying the ninth position among institutions of Latin America. In 2015 the Ranking UniversitárioFolha (RUF) ranked UFRJ as the second best university in Brazil and the best Federal University in the country.

Coppe – Alberto Luiz Coimbra Institute for Engineering Graduate Studies and Research of UFRJ – is the largest engineering and research center in Latin America. Founded in 1963 by the engineer Alberto Luiz Coimbra, he helped to create postgraduate courses in Brazil and, over the course of five decades, he trained more than 13 thousand masters and doctors in his 12 strictosensu postgraduate programs (masters and doctorates) . In 2013, Coppe created its 13th program: Nanotechnology Engineering.

Supported by three pillars - academic excellence, exclusive dedication of teachers and students and proximity to society - Coppe is a producer and knowledge center, qualified professionals and teaching methods. Its quality standards in teaching, research and interaction with society have been adopted as models in universities and research institutes throughout the country.

It is the Brazilian engineering institution with the highest number of marks awarded by Capes to courses with equivalent performance to the most important teaching and research centers in the world. Half of its 12 postgraduate courses included in the last evaluation of Capes conquered concept 7 and four received concept 6, the highest system. Graduates annually more than 500 masters and doctors. Their students are prepared to deal with frontier topics of knowledge without losing touch with reality and the demands of society.

Coppe has the largest engineering laboratory complex in Latin America, with more than 100 high-level facilities, in which it transforms research results into wealth for Brazil. Through agreements and agreements with companies, governments and non-governmental entities managed by the Coppetec Foundation, the knowledge accumulated in Coppe is directly put at the service of the country's economic, technological and social development. Since its creation in 1970, Coppetec has managed more than 12,000 contracts.

In tune with the future, she was a pioneer in bringing the academy closer to society, transforming knowledge into wealth for the country. His intense participation in the development of technologies for the oil industry contributed to make Brazil a leader in the exploration and production of oil in deep waters. Its historical partnership with Petrobras is a world reference of a successful case between company and university.

Since 1994, the institution has maintained the Coppe / UFRJ Business Incubator, which has already favored the entry of more than a hundred innovative services and products in the market. It stimulated the creation of the Technological Park of UFRJ, located in the University City, which brings together research centers of large companies and several laboratories of Coppe, among them LabOceano, inaugurated in 2003, the first installation of the Park.

It was also a pioneer in putting engineering and its technologies at the service of combating poverty and social inequalities. The Technological Incubator of Popular Cooperatives, created in 1995, has graduated more than one hundred cooperatives. Its model has become a reference and has been replicated in several Brazilian states and in other countries. The recent creation of the Herbert de Souza Laboratory of Social Technologies has been increasing the institution's performance in this area.

Coppe has become a national and international reference in engineering teaching and research and has been helping Brazil to face some of the most recent challenges in its recent history. In the international scenario, it has projects in cooperation with the most important and recognized scientific and technological institutions. Many of its faculty members include committees and research entities from various countries and multilateral bodies, such as the UN Intergovernmental Panel on Climate Change (IPCC). More recently, a partnership with Tsinghua University in China has resulted in the establishment of the China-Brazil Center for Climate Change and Innovative Technologies for Energy.

A pioneer in climate change adaptation studies, Coppe hosts the Brazilian Forum on Climate Change, the Brazilian Panel on Climate Change and the World Center for Sustainable Development (Rio + Center).

3.3.1.2 IMPA

http://www.impa.br/opencms/en/

The Instituto Nacional de Matemática Pura e Aplicada (IMPA; English: National Institute for Pure and Applied Mathematics) is widely considered to be the foremost research and educational institution of Brazil in the area of mathematics. It is located in the city of Rio de Janeiro, and was formerly known simply as *Instituto de Matemática Pura e Aplicada*, hence its official abbreviation.

As of 2015, IMPA does research in algebra, analysis, differential geometry, partial differential equations, computer graphics, fluid dynamics, holomorphic dynamics, mathematical economics, symplectic geometry, algebraic geometry, optimization, probability theory, dynamical systems, and ergodic theory. It is aiming to expand its lines of research to include topology, number theory, combinatorics, and discrete mathematics in general and its applications.Artur Avila, a 2014 Fields Medalist, is a researcher at IMPA and received his Ph.D there.

3.3.1.3 UFPE / CIN

https://www.ufpe.br/english/

Federal University of Pernambuco (Portuguese: Universidade Federal de Pernambuco, UFPE) is a public university located in Recife, Brazil, established in 1946. UFPE has 70 undergraduate courses and 175 postgraduate courses. UFPE has 35,000 students and 2,000 professors. The university has three campuses: Recife, Vitória de Santo Antão, and Caruaru. Its main campus, or "CidadeUniversitária", has 12 academic centers. It is located in the west part of Recife, in the Várzea neighborhood.

UFPE ranks among the top Brazilian universities, being the ninth university both in size and scientific production, and the seventh among the federal institutes. Many Graduate courses at UFPE are of recognized excellence, such as Computer Science, Physics, Mathematics, Psychology and Chemistry, according to the assessment performed by CAPES. UFPE's faculty counts with 2.366 lecturers, 71% of which hold a PhD degree. The student body consists of 28.688 undergraduate students, 2750 students enrolled in Masters courses, 360 enrolled in Master's for Industry courses, 1600 PhD students and 1.500 students enrolled in Graduate Specialization courses offered at UFPE.

UFPE's Center for Exact and Natural Sciences is consistently the strongest in research production in the university. CAPES ratings are Physics Department (rating 7/7), the Informatics Center (rating 6/7) and the Chemistry Department (rating 6/7).

UFPE has been elected twice as the best university of north and northeast Brazil by Guia do Estudante (a national university ranking magazine) and Banco Real (ABN AMRO). Each year over 6,000 seats are offered in a competitive entry exam (Vestibular). The median and average competition rate is of about 10 applicants for each seat.

The Informatics Center (CIn), one of the 12 UFPE's academics centers, is the active unit participating in this project. CIn was established 43 years ago, in 1974. At that point, CIn only offered the MSc in Informatics course. Currently, CIn is ranked among the top quality academic centers in Latin America. This is due to the high level of its faculty, that consists of over 80 PhD as well as to the large scope of the research performed there, which covers both classic and novel areas. The Graduate Program at CIn, established in 1974 and accredited in 1986, is one of the top 5 Computing Graduate

programs in Brazil. Our program was assessed by CAPES as level 6, and is the only one that counts with a PhD course in the North and Northeast of Brazil.

CIn has a significant impact in the ICT ecosystem – be it at the local, regional or national levels. As an acknowledgment of its excellency, in December 2011, CIn received Finep's Technological Innovation award, in the Best Scientific and Technological Institution Category.

CIn's scientific production has been increasing steadily over recent years. Besides publishing books and book chapters, each year, approximately 15 papers are published in international indexed journals, and 1000 papers are published in both national and international conferences. CIn is a reference in many areas of Computing in Brazil. Its yearly production results from the intense research work carried out in the context of over 50 R&D projects, which count with national and international partners.

3.3.1.4 UFMT

http://www.ufmt.br/ufmt/site/

The Federal University of Mato Grosso (Portuguese: *Universidade Federal de Mato Grosso*, UFMT) was created in 1970. Located in the capital city of Cuiabá, it serves the entire state of Mato Grosso, Brazil. Teaching, research and extension programs are concentrated in 12 graduate programs, 63 undergraduate courses and a variable number of diploma courses in life, social and exact sciences. Nearly 20,000 students are formally enrolled. Its Medicine Faculty got, in 2007, the best average grade among Brazilian Medicine schools in the ENADE (National Students Exam).

3.3.1.5 SENAI / ISI-TICs

http://www.pe.senai.br/principal-senai/instituto-senai-de-inova%C3%A7%C3%A3o

To integrate project goals and results with industries requirements, SENAI (National Service for Industrial Apprenticeship) is renowned as a model of technical, professional and higher education, being the World Skills 2015 winner. It is also well-known for the

quality of its technological services that promote innovation in the Brazilian industry. SENAI also operates a certified network of 208 laboratories offering technical and technological services to companies throughout the country. In 2011, this network serviced more than 18 thousand companies, and 139,149 services were undertaken to support industrial innovation and technological development. SENAI is part of the Industrial System, along with the Brazilian National Confederation of Industry (CNI), the Social Service of Industry (SESI), and the Euvaldo Lodi Institute (IEL).

The SENAI Innovation Institute for Information and Communication Technologies (ISI-TICs), one of the 25 SENAI Innovation Institutes, is SENAI's operational unit actively participating in this project. ISI-TICs is stablished in Recife, Pernambuco, Northeast of Brazil. Its goal is fostering Brazilian Industry productivity throughout innovation with ICT (Information and Communication Technologies). Despite being created from scratch in 2014, the Institute already executed 17 projects and 16 projects are being executed. ISI-TICs executes innovation projects in collaboration with other SENAI Innovation institutes and Brazilian Universities.These projects are executed with multinationals companies, such as GM, Whirlpool, and SIEMENS, as well as Brazilians big, medium, small, and startups companies. The 33 projects account more than R$ 13.000.000,00.

3.3.1.6 PROTESTE:

www.proteste.org.br

Proteste is the largest consumers organizations in Latin America. Is a research and defender institute in Brazil. The team will coordinate product distribution and prototype implementation, training, tests and maintenance at costumer premises, as well customer research and evaluation of consumer goods.

3.3.1.7 ALIGER:

www.aliger.com.br

Aliger intelligence of things is the outstanding IoT with Artificial Intelligence integrator, wireless sensor development and manufacturer, developing tailor made projects for companies, cities, farms, industries and so on. It team will share prototypes and technologies developed before to improve their products, firmware, technology and algorithms. It will also support development of proprietary sensors that still not available at market yet. Company intend to provide the technology developed in this project to worldwide market.

European Members:

3.3.1.8 HochschuleRheinMain University of Applied Sciences

http://www.hs-rm.de/hochschule/startseite/index.html

RheinMain University of Applied Sciences was founded in 1971. Also was called University of Applied Sciences Wiesbaden (German: *Fachhochschule Wiesbaden*). Since September, 1st of 2009 the University of Applied Sciences is called RheinMain University of Applied Sciences.

At the RheinMain University of Applied Sciences a wide variety of study programs is offered. The faculties of Social Sciences, Architecture and Civil Engineering, Design – Computer Science- Media, and the Wiesbaden Business School are located in Wiesbaden. The Faculty of Engineering is situated nearby Rüsselsheim, and the Geisenheim Faculty can be found in Geisenheim.

More than 9.000 students study at RheinMain University of Applied Sciences: 5.200 in Wiesbaden, 2.600 in Rüsselsheim and 1.100 in Geisenheim (in summer 2009). They are enrolled in 46 different degree programs, including part-time and cooperative, distance learning and master's programs. The transition to bachelor's and master's programs is completed. The RheinMain University of Applied Sciences has about 600 employees, 210 of them are professors.

3.3.1.9 University of Paris-Sud

www.u-psud.fr

University of Paris-Sud (French: *Université Paris-Sud*), also known as University of Paris XI, is a French university distributed among several campuses in the southern suburbs of Paris. The main campus is located in Orsay. This university is a member of the UniverSud Paris and a constituent university of the federal University of Paris-Saclay.

Paris-Sud is one of the largest and most renowned French universities, particularly in science and mathematics. Four Fields Medalists and twoNobel Prize Winners have been affiliated to the university.

Paris-Sud was originally part of the University of Paris, which was subsequently split into several universities. After World War II, the rapid growth of nuclear physics and chemistry meant that research needed more and more powerful accelerators, which required large areas. The Université de Paris, the ÉcoleNormaleSupérieure and the Collège de France looked for space in the south of Paris near Orsay. Later some of the teaching activity of the Faculty of Sciences in Paris was transferred to Orsay. The rapid increase of students led to the independence of the Orsay Center on March 1, 1965.

Now it hosts a great number of laboratories on its large (236 ha) campus. Many of the top French laboratories are among them especially in particle physics, nuclear physics, astrophysics, atomic physics and molecular physics, condensed matter physics, theoretical physics, electronics, nanoscience and nanotechnology. University of Paris-Sud comprises some 104 research units.

About 30,000 students are currently enrolled. Pierre-Gilles de Gennes and Albert Fert, two Nobel Prize winners of physics, were affiliated to the University of Paris-Sud. A number of most renowned French mathematicians are or were affiliated to the University of Paris-Sud as well. Among them are the Fields medalists Laurent Lafforgue, Jean-Christophe Yoccoz, Wendelin Werner and NgôBảoChâu.

3.3.1.10 OpenData Institute:

www.theodi.org

The Open Data Institute (ODI) is a profit private, based in the United Kingdom. Founded by Sirs Tim Berners-Lee and Nigel Shad Bolt in 2012, the ODI's mission is to connect, equip and inspire people around the world to innovate with data.

The ODI's global network includes individuals, businesses, startups, franchises, collaborators and governments who help to achieve this mission.

The ODI undertakes research on a broad range of areas related to open data. This includes exploring the evidence for the impact of open data; research and development of tools and standards to assist producers, publishers and users of open data; examining the implications, challenges and opportunities of deploying open data at web scale; and applications of open data to address or illuminate real-world problems.

Ongoing projects include: Mapping and understanding the scale of open data's potential value in business, with reports to date analyzing open data companies that create products and services, and how three big businesses – Thomson Reuters, Arup Group and Syngenta create value with open innovation.

Data-and-Platform-as-a-Service (DaPaaS), which simplifies the consumption of open (and linked) data, by delivering a platform for publishing, consuming and reusing open data, as well as deploying open data applications.

OpenDataMonitor, which provides users with an online monitoring and analytics platform for open data in Europe. It will provide insights into open data availability and publishing platforms by developing and delivering an analysis and visualization platform that harvests and analyses multilingual metadata from local, regional and national data catalogues.

Share-PSI is the European network for the exchange of experience and ideas around implementing open data policies in the public sector. It brings together 45 partners covering 26 countries with representatives from government departments, standards bodies, academic institutions, commercial organisations, trade associations and interest groups.

DaPaaS and OpenDataMonitor are co-funded by the Seventh Framework Programme for research and technological development (FP7). Share PSI is co-funded by the European Commission under the ICT Policy Support Programme (ICT PSP) as part of the Competitiveness and Innovation Framework Programme.

5. MEMBER OF THE CONSORTIUM

5.1 PARTICIPANTS

The list of participants of the consortium and the respective representing person are organized in the **Table 10**.

Table 10: Scheme Of Consortium

ALIGER PROJECT MEMBERS - GEOGRAPHIC AREA: BRAZIL					
REF:	INSTITUTION	COUNTRY	UPHOLDER	ALLOCATION	ROLE
1	COPPE UFRJ / COPPETEC FUNDAÇÃO		**Marcos do Couto Bezerra Cavalcanti**	Professor, Ph.D, specialist in knowledge management, enterprise intelligence, network science, big data, evaluation of intangible assets, knowledge society, smart cities and electronic government. http://lattes.cnpq.br/3555029573688410	**Project Coordinator BRAZIL**
			Suzana Kahn Ribeiro	Professor, Ph.D, specialist in renewable energy, climate change, sustentable mobility, smart cities and environment http://lattes.cnpq.br/2988769640029659	Consultant
			Cristiano Placsek Borges	Professor, Ph.D, specialist in water reuse and sewage treatment with membranes, water and gas flow control and meters, organic sewage process, Water and gas chemical analysis and level sensor devices. http://lattes.cnpq.br/2694587316846422	Consultant
			Daniel de Magalhães Chada	Dsc, Data scientist, specialist in cognitive science, cognitive methods, sparse distributed memory, large dimensional binary vectors and perception, data Science, algorithms and machine learning. http://lattes.cnpq.br//3503B/4013588B	Consultant
2	impa		Luiz Carlos Pacheco Rodrigues Velho	Professor, Ph.D, specialist in computer vision, algorithms, deep Learning, machine learning, computer graphics and artificial intelligence. http://lattes.cnpq.br/9500245604678806	Consultant
3	UFPE		Kiev Santos da Gama	Dsc, specialist in: applied research in the context of Internet of Things and Smart Cities, including following areas: Distributed systems, middleware and component-based software engineering. http://lattes.cnpq.br/6105519705564724	Consultant
			Paulo Henrique Monteiro Borba	Dsc, specialist in software engineering, programing languages, software modules, evolution and program model transformation. http://lattes.cnpq.br/9395715443254344	Local Coodinator
4	UFMT		Einstein Lemos de Aguiar	Professor, Dsc, specialist in knowledge management, computer science, information engineering, production management, artificial intelligence, technology & society. http://lattes.cnpq.br/7560224709886410	Local Coodinator & Risk Manager
5	INSTITUTO SENAI DE INOVAÇÃO		Sergio Castelo Branco Soares	Professor, Ph.D, Specialist in: Computer science, experimental software engineering, software modularity, oriented object software development, firmware development, electronic sensoring. http://lattes.cnpq.br/6456667007502521	Industrices / Project Integration Manager
6	PROTESTE		PROTESTE BRAZIL LOCAL TEAM	Proteste is the largest consumer's relation, research and defender institute in Brazil. It team will coordenate product distribution and prototype implementation, training, tests and maintenance at costumer premisses, as well customer research and evaluation of consumer goods. www.proteste.org.br	Customer interaction & Research
7	ALIGER		ALIGER BRAZIL LOCAL TEAM	Aliger intelligence of things is the outstanding IoT with Artificial Intelligence integrator, wireless sensor development and manufacturer, developing tailor made projects for companies, cities, farms, industries and so on. It team will share prototypes and technologies developed before to improve their products, firmware, technology and algorithms. It will also support development of proprietary sensors that still not available at market yet. Company intend to provide the technology developed in this project to worldwide market. www.aliger.com.br	Hardware prototypes & products homologation

ALIGER PROJECT MEMBERS - GEOGRAPHIC AREA: EUROPE					
REF:	INSTITUTION	COUNTRY	UPHOLDER	ALLOCATION	ROLE
1	UNIVERSITÉ PARIS SUD		**Ahmed Bounfour**	Professor, Ph.D, Ahmed Bounfour is holder of the European chair on intellectual capital at the University of Paris-Sud, France. He is the scientific leader of the ISD international research program for CIGREF Foundation and editor of the book series SpringerBriefs in Digital Spaces. He is vice chairman of The New Club of Paris, an agenda developer for the Knowledge Economy. The Club's main objective is to create awareness on what the knowledge society is and will be, and also support nations, regions, cities, communities organizations and companies in their transformation into the Knowledge Economy. He is specialist in intangible assets and Digital world business model. Professor Ahmed and his team will research new business model hypothesis to be tested through project phases til the conception of the right business model to go to market. http://www.ritm.u-psud.fr/researchers/ahmed-bounfour/	Digital Business Model Coordinator
2	Hochschule RheinMain University of Applied Sciences Wiesbaden Rüsselsheim Geisenheim		Klaus North	Professor, Ph.D, Specialist in knowledge based economics and Sustainable competitiveness of small and medium enterprises in turbulent economic and social environments. He will help us to design a meta national business model value chain to use best knowledge places and resources to interact with shareholders and customers of Aliger project. He and his team will take care of the knowledge management of best practices uses for EU in collaboration with processor Marcos Cavalcanti from UFRJ that will take care of these same practices in Brazil geography. http://www.north-online.de/en/index.html	KM and Customer Awareness Coordinator
3	open data institute		Europe Team	Open Data Intitute team will work to mitigate risks and avoid data and transactions inconsistency using their worldwide outstanding methods and process to certify that information available to customers, partners and ecosystem will be reliable, safety and wholeness according to the information requested, level of detail and capacity to integrate with other applications. http://theodi.org/	Risk, Transaction and Data Integrity Management
4	TEST ACHATS		**Giorgia Caroli and her local team**	Test-Achats teste is the largest consumer's association, to research and defender in Belgium for more than 60 years and almost 1 million members. It team will coordenate product distribution and prototype implementation, training, tests and maintenance at costumer premisses, as well customer research and evaluation of consumer goods in Europe. www.test-achats.be	Customer interaction & Research
5	ALTROCONSUMO		Altroconsumo Team	Altroconsumo is the largest consumer's relation, research and defender institute in Italy. With 44 years of work on consumers subjects and more than 350.000 members www.altroconsumo.it	Customer interaction & Research
6	DECO PROTESTE		Decc Team	Deco Proteste is the largest consumers relation, research and defender institute in Portugal. With 43 years of work on consumers subjects and more than 400.000 members www.deco.proteste.pt	Customer interaction & Research
7	ocu		Ocu Team	OCU is the largest consumer's relation research and defender institute in Spain. The organization have more than 42 years and 250.000 members. www.ocu-F3.org	Customer interaction & Research

5.2 THIRD PARTIES INVOLVED IN THE PROJECT (INCLUDING USE OF THIRD PARTY RESOURCES)

No third parties involved

6. CONCLUSIONS

The project, if approved, will impact directly five countries (Brazil, Portugal, Spain, Italy and Belgium), in two different continents (South America and Europe), and indirectly more countries (Germany, France and England). Brazilian historically disadvantaged regions, the Northeast and Middle-West, will have direct impact with the implementation of the project and the monetary support for academic institutions.

The development of technology that can unify the evaluation of products can bring an easier way to manage houses, companies and public places that will not depend on the manufacture of products. The new tools are almost ready to become the life of normal family in a new laboratory of ideas and efficiency to improve the wellbeing and support to life.

The implementation of a pilot that will promote the Internet of Things concept, on consumer residences, can be an advantage for the consortium participants that will have important and relevant information about consumer behavior. On the other side, that kind of information will be very helpful to Consumers Organizations that can use, not only consumer behavior, but also the household appliances. It can provide new evaluation of the products, one of the main activities of those organizations. They advise efficient products, tested at laboratories, to recommend the best choice to consumers, avoiding the waste of resources. That kind of approach can amplify the activities of Consumer Organization on our society.

In a deep and future analysis the implementation of this project will contribute to the improvement of the knowledge of resources management, reduce the footprint of our society and head our technologies to solve the present problem of entire humanity. Unfortunately, the environmental issues are still increasing.

All topics mentioned on this article are related to the requirements imposed by 'EUB-02-2017: IoT Pilots'. Due to the complexity of the implementation of the project, the approach related to the usability of the product can be addressed more in depth in future articles and studies. Independently of the approval of the project, we suggest to future works to approach the usability of the interaction between IoT products and consumers. The role of citizens is crucial to the acceptance and dissemination of technologies, for that, the participation of the consumer in that phase is advised.

7. REFERENCES

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