

# AVANTI: An Intelligent Vehicle Project as a Catalyst for Education and Business Collaboration and Regional Economic Regeneration

Juan Manuel Lopez, Adriana Sánchez

Division of Professional Studies

ITESM Campus León

León Guanajuato, México

{juan.manuel.lopez, adriana.sanchez}@itesm.mx

Victor Zamudio

Division of Postgraduate Studies and Research

Instituto Tecnológico de León

León Guanajuato, México

vic.zamudio@ieee.org

Vic Callaghan

School of Computer Science and Electronic Engineering

University of Essex

Wivenhoe Park, United Kingdom

vic@essex.ac.uk

**Abstract**—Avanti is an international and multidisciplinary project, were undergraduate students, from different backgrounds, have the challenge to design an intelligent vehicle for the Mexican elderly in 2020. This venture is motivated by the convergence of a set of different initiatives: the creation of a new Technology Park, the desire to create a new technology-based businesses and the to need to attract students, innovators and entrepreneurs to propose new solutions to global needs. In this work we are assisted by a group of experts from different geographical regions (Mexico, Spain, Italy and United Kingdom) who help teams of students address this challenge. This short paper presents our work-in-progress by introducing the concepts, people (some 23 teams of students) and challenges associated with this project.

**Keywords:** *intelligent vehicles, technology innovation, elderly*

## I. INTRODUCTION

In the coming years, the demography of Mexico will undergo massive change as the proportion of elderly people increases significantly. This will place increasing demands of family and government as elderly people generally need greater assistance in order to continue with their normal life. Mexico is not alone in facing this challenge and numerous other countries, such as the UK, the USA and Korea are all investing heavily in such work [8, 9, 10, 11]. In México there is a clear and strong necessity to prepare for this eventuality with the help of, not only of the government, but entrepreneurs, academics and researches. This project is based in a University innovation park where one of the biggest challenges is to motivate Mexican students, from different backgrounds and skills, to take an active role, working towards finding solutions to future challenges. This task is not easy, as it implies complex

technological solutions, funding and innovative ideas of which the work we describe in this paper is a first step.

## II. TECNOLOGICO DE MONTERREY

The project is based in the Tecnológico de Monterrey which is also known as ITESM and was founded in 1943 as a non-profit association called Enseñanza e Investigación Superior, A. C. Tecnológico de Monterrey is a private, non-profit institution independent of, and not related to, any political party or religious group.

The work of the Tecnológico de Monterrey and of all of its campuses is supported by civil associations made up of a large group of outstanding leaders from all parts of the country, which are committed to quality in higher education. Today, Tecnológico de Monterrey is a multi-campus university system with academic centers in different regions of the country [1]. Tecnológico de Monterrey has been accredited by national and international agencies both as an institution and for the academic programs offered by its campuses. In particular, it has been accredited by the Southern Association of Colleges and Schools SACS [4].

---

*We want to thank ITESM Campus Leon for sponsoring this project*



Figure 1. Students taking part on the Avanti Project.

#### A. Educational Model

The educational model is aimed undergraduate students, places in which students manage their work with the professor playing the role of a facilitator, guiding the students in discovering knowledge and how to apply it on their own.

To achieve these objectives, the educational model emphasizes collaborative work and uses didactic techniques such as problem-based learning, project-oriented learning, and the case-solving method all focused on the intelligent vehicle application. In this way knowledge is applied to solving real-life problems including critical reflection and social commitment which all contributes to making their studies more meaningful.

#### B. Business incubators, accelerators and Technology Parks

Technology parks are sites designed to be conducive to capitalizing on the knowledge generated at the universities and transforming it into economic and social wealth, as well as in regional development. They are effective tools for knowledge transfer and for the creation and attraction of competitive enterprises. Establishing and operating technology parks is a cornerstone of the innovation system of the Tecnológico de Monterrey's R&D area. The following four models served as starting points for the establishment of these parks [1]:

- Parks for high value job development, enabling students and alumni to be employed in advanced R&D activities.
- Centers for technology transfer and technology-based company acceleration and landing, paving the way for the marketing and transfer of Tecnológico de Monterrey and regional technologies to national and international high value companies.
- Centers for the research and establishment of technology-based companies positioning the Tecnológico de Monterrey internationally on the strength of these activities.

- Innovation and technology parks, which will contribute to transforming the regional economy.

In Tecnológico de Monterrey Campus León, Technology Park CIEN is planning to begin operations in August 2010, with an investment of 10 million dollars, and a joint effort of government and ITESM. The AVANTI project is linked to the Technology Park in the following terms:

- a. Providing a hub where collaboration and interchange of ideas can make things happen, enrolling not only students and academics, but also businessman and researches from different backgrounds and areas of expertise.
- b. Incubating successful and innovative initiatives, solutions and products.
- c. Promoting student entrepreneurship, and in particular technology-based business, focusing on global and local needs, according to global-trends.

### III. THE CHALLENGE

The core challenge to the students is *to design and develop an intelligent vehicle for the future elderly people in Mexico, in 2020*. From this project, the end-user (customer) should get a number of benefits from the *intelligent vehicle* technology, in terms of comfort, security and leisure.

#### A. Project Specifications

To frame the project, and guide the student's design goals, the *intelligent* vehicle was given the following high-level specifications:

- i. *Market*: independent and semi-independent elderly adults.
- ii. *Use and interfaces*: limited speed, easy access with wheelchair or walking stick, lack of pedals.
- iii. *Style*: futuristic, Mexican identity and nostalgia.
- iv. *Technology*: electric motor, use of tires, sensors, embedded computer systems, GPS, Wi-Fi, voice commands, windows sync, mobile connectivity, secure sensors in case of emergencies, permanent monitoring.
- v. *Industrial production*: made in Mexico
- vi. *Materials*: 95% recyclables.
- vii. *Business Model*: detailed description of vehicle, description of a specific problem tackled, differentiation factors and innovation, global valuation of strengths and risks.
- viii. *Marketing*: market research, industrial analysis, future trends, benchmarking defining main characteristics of direct and indirect international

competition, market share and marketing strategies, product strategies including both tangible and intangible features, definition of the company image.

- ix. *Financial aspects*: initial investment requirements, daily production, and production costs.

A summary of the main specification areas is shown in Fig. 2.

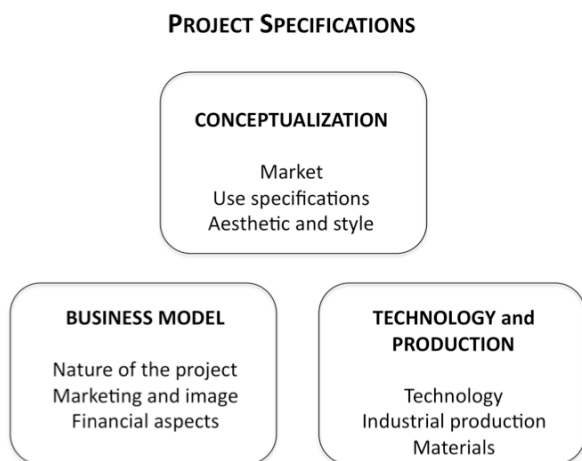


Figure 2. Summary of the project specifications

### B. The Teams

Twenty three teams are participating in this contest: CIBI, VIATGEARS Team, 360, Koltin, Neo's Team, Ecco Design, Hooligans, Legendory, Vento Saggio, Los Chidos, Sunny, EcoHC, Motion Design, Racers, Adagio, Celor Team, Attimo, Tutto Avant, Vantaggio, Li imaginanti, Sinergy Force, Stap, Neo Classique. Each team is composed of students with different backgrounds: industrial design, digital art, industrial engineering, mechatronics, international business, finance and marketing. Each team has assigned a tutor, in order to supervise their work, answer general questions, and coordinate the different activities the teams are involved in. It is important to clarify that each team should provide a solution to the challenge mentioned in section III.

### C. The consultants

A team of international experts and academics from leading companies and universities are collaborating on this project, such as Pininfarina, Fiat, Alfa Romeo, Tecnologico de Leon, University of Essex and Tecnológico de Monterrey.

A number of lectures, conferences and workshops are scheduled, covering the following topics: design process, trends in the automotive industry, telemedicine, ergonomics, car safety, Interior design and automotive interfaces, megatrends in car design, materials, manufacturing process, planning projects, competitiveness and innovation, safety, international marketing, Technology and business models transfer, and ambient intelligence. Some of the lectures and conferences, are held using videoconferences, with the help of Elluminate, Skype and blackboard [5,6,7].

In addition to the lecture and conferences, the participants are required to submit a number of assignments, described below, which make up the project deliverables.

### D. Deliverables

By way of providing a record of the project work, a set of design templates and a means of evaluation, the project comprise the following deliverables:

1. Documentation of the business model
2. Storyboard, sketches, photos and renders of the final scenario.
3. A DVD with animations showing the full functionality of the vehicle and a video for marketing purposes.
4. Two prototypes: In order to avoid the technical complications that could naturally arise during the process, two complementary prototypes are requested: one focusing on the design, and another showing the functionality and strategy of access to the vehicle for the case of a user with special needs. In both cases the prototypes should be build using thermoplastic or thermophilic materials illustrating the characteristics mentioned before.
5. Prototype of the device for monitoring vital signs linked to a module to manage emergencies.

## IV. CONCLUSIONS AND FUTURE WORK

Avanti is a multidisciplinary project where students from different backgrounds face the challenge of designing, -in a 14 week period- a vehicle for Mexican elderly in 2020. The best 10 teams will be presenting their work in Torino, during the summer of 2010.

Consultants, experts and academics from Italy, Spain, United Kingdom and Mexico take part in the project, providing guidance and support for the 23 teams taking part on this project.

The project is in its initial stage, and the students are showing enormous motivation and interest. We can see students with an original background in marketing talking

about sensors and actuators, industrial designers discussing about vital signs monitoring, etc. It is important to mention that all the students enrolled in Avanti are full time students, and their participation is optional. In spite of the extra workload, it has attracted a large number of students, due to its multi-faceted nature which offers the students a novel, interesting and rewarding experience including the possibility of working with experts from around the world in a real-life problem. Avanti offers also the possibility of innovate and collaborate in a multidisciplinary environment on topics ranging from arts to engineering. Intelligent Environments have been identified by numerous leading companies and academic researchers as the next wave of next life changing technology, taking many forms from smart homes to intelligent vehicles. Avanti finds synergy with this vision by focusing on the design of an intelligent vehicle.

This project is directly linked with CIEN Technology Park at ITESM Campus Leon. We hope that successful projects will produce novel science, art and products that should be able to incubate in the Technology Park CIEN, triggering innovation and new technology-based business in our region, which can capitalise on mega markets and global needs.

This is a work-in-process, involving a large multi-disciplinary and international team that will run over many years and we hope to report our results in future conferences. We hope that these concepts and methods will prove valuable to other areas of the world that are seeking to invigorate their economies through high-tech enterprises such as intelligent environments.

## ACKNOWLEDGMENT

We want to thank the support and valuable suggestions and comments from Mario Adrian Castro, Pilar Muñoz, Francisco Valderrey and Fabiola Cortés, and all the external and internal consultants taking part on this project.

## REFERENCES

- [1] Tecnológico de Monterrey, official website. [online]. Available: <http://www.itesm.edu>. [Accessed: May 26, 2010].
- [2] Avanti Proyect, facebook webpage. [online]. Available: <http://www.facebook.com/group.php?v=info&gid=135484144177>. [Accessed: May 26, 2010].
- [3] Avanti Proyect, official website. [online]. Available: <http://www.avanti-tec.com>. [Accessed: May 26, 2010].
- [4] Southern Association of Colleges and Schools. [online]. Available: <http://www.sacs.org>. [Accessed: May 26, 2010].
- [5] Elluminate, official website. [online]. Available: <http://www.illuminate.com>. [Accessed: May 26, 2010].
- [6] Skype, official website. [online]. Available: <http://www.skype.com>. [Accessed: May 26, 2010].
- [7] Blackboard, official website. [Online]. Available: <http://www.blackboard.com>. [Accessed: May 26, 2010].
- [8] The Hong Kong Council of Social Services. [online]. Available: [http://www.hkcss.org.hk/institute/en\\_intro.html](http://www.hkcss.org.hk/institute/en_intro.html). [Accessed: May 26, 2010].
- [9] Senior Citizens' Resources. Official information and services from the U.S. government. [online]. Available: <http://www.usa.gov/Topics/Seniors.shtml>. [Accessed: May 26, 2010].
- [10] Administration on Aging. [online]. Available: <http://www.aoa.gov>. [Accessed: May 26, 2010].
- [11] Over-60s, National Health Service NHS. [online]. Available: <http://www.nhs.uk/LiveWell/Over60s>. [Accessed: May 26, 2010].