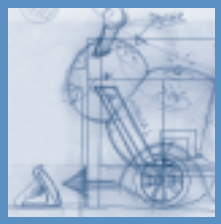
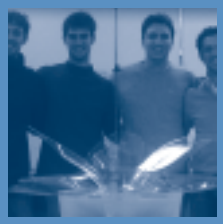
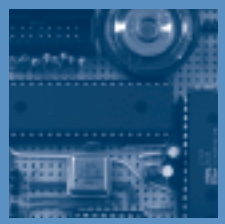


PROJECT 1





AmoRoSA

AUTONOMOUS MOBILE ROBOTS FOR SERVICE APPLICATIONS

project 1

Autonomous Mobile Robots for Service Applications. Companies: Microsystems, Itoys. Projects: A sensitive plant, an intelligent toy, a movable ceiling lamp.

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EXTERNAL INSTITUTIONS

Interactive Toys

Microsystems

EXTERNAL TUTORS

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Automation Engineering

Marco Garlaschè
Mechanical Engineering

Paolo Giamminonni
Biomedical Engineering

Fabrizio Giordano
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Davide Mazza
Computer Engineering

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Luisella Borra
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Environmentally friendly product design

Maria Beatrice Criniti
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Luigi Malagò
Computer Engineering

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Mechanical Engineering

Tatiana Chierici
Interior Design

Luca Frasson
Biomedical Engineering

Diego Quadrelli
Architecture

Claudio Roncuzzi
Materials Engineering

PROJECT DESCRIPTION

The project was oriented towards autonomous mobile robots, that are products of growing interests in the consumer market (surveillance, cleaning, gardening, impaired people support, etc).
In order to achieve the exploitation of the research, strong constraints were defined: the goal was to obtain low-cost products able to satisfy the requirements of the market and not only of niches. In fact, the aim of the project was the implementation of solutions compatible with market requirements through the development of new methodologies and technologies.
Many people took part in this project: three student groups, academic tutors and companies. The three groups of students carried out their activities in different complementary fields, to explore various solutions for a wide market: intelligent furniture complements, intelligent toys and intelligent multipurpose lighting.
The first project, relevant to intelligent furniture complements, concerned a robotic flower, initially intended as a "gadget", capable to react to user gestures and to work also as a barometer, a perfume dispenser and a personal lighting device. The second project focused on cheap, intelligently flexible toys, easy to use and able to evolve; an intelligent toy-car (or caterpillar, or other) that could detect the signals (RFID buttons) arranged by the user and to interact with them, both for moving (turn, stop, speed up, etc.) and for matching goals (collect points, discover clues, etc.). The third project regarded a remotely controlled ceiling lamp, capable of changing from soft light to a directional spot. It could also be programmed to descend from the ceiling, becoming a personal lamp. All three projects required a lot of different skills and a multicultural approach: mechanical elements to be moved; electronics for most of the functions; automation controls apt to define interaction and behaviour; definition of user's scenarios; biological aspects concerning of psychology interaction and human responses; electronics for circuitry and power; information technology necessary to provide proper software controls; design to define roles and to insert semantics into the shapes and, finally, management to maintain production costs adequate for the market.

The aim of the project was to drive ideas, providing also the experience of the problems arising from the real production: the tutors compelled the implementation of demonstrating prototypes for each project. The result was really impressive: in a short period of time the prototypes highlighted problems under several aspects (mechanics, electric power, size, shape, appeal, costs, etc.), fostering solutions and increasing interactions among the various disciplines; prototypes changed heavily and quickly.
Experience went beyond our expectations: during the final stages, the initial goals of modularity and flexibility forced us to interact with other companies (not competing with the official ones), in order to obtain support and materials for further experimentations and improvements in different fields. Legoled, provided diode lamps for the lighting aspects in more than one project and Oikos, supplied advanced electronically controlled perfume dispensers. Their unrequested interest and availability, as well as the regular and effective presence of the official companies, clearly testify the significance of the projects in opening new market areas.

FLOrobot

ABSTRACT

The main purpose of FLOrobot project is to develop a system targeted at the entertainment world. The secondary aim is the creation of a sort of weather station. These refer to the collective imaginary of a fantasy world, where plants and flowers show extraordinary features and are endowed with their own behaviour.

An analysis of the problem was performed in order to determine possible market areas concerning to different customers' needs.

An autonomous system, suitable for simulating the main features of a plant lifecycle is not yet available on the market. Therefore, the purpose of this research is to study a way to create an autonomous plant able to react to environmental conditions and interact with the user.

The potential scenarios for the product positioning on the market change depending on the different functions that could be implemented. It could be seen as:

- a furniture complement able to create a relaxing atmosphere;
- a game toy for people looking for interaction with a plant and willing to take care of it as if it was real;
- a weather station: external sensors transmit to the plant informations on atmospheric pressure and temperature and the plant displays them to the user in a behavioural manner according to the specific weather conditions.

The following section focuses on the state-of-the-art in the entertainment robot world. Then the description of feasible and innovative solutions is provided, along with the main features of the robot and the general construction issues.

TASKS & SKILLS

Ivo Boniolo, experienced in automation engineering, was responsible for managing movement and control frame components choice. He worked on the prototype together with Francesco Brasacchio and Marco Garlaschè.

Francesco Brasacchio, took care of the project usability, scenario settings, materials and prototyping. He was responsible for project visualization and presentation.

Marco Garlaschè, was responsible for the mechanical analysis in the project and carried out the prototype.

Paolo Giamminonni, managed the Zigbee wireless communication protocol and controller interfacing.

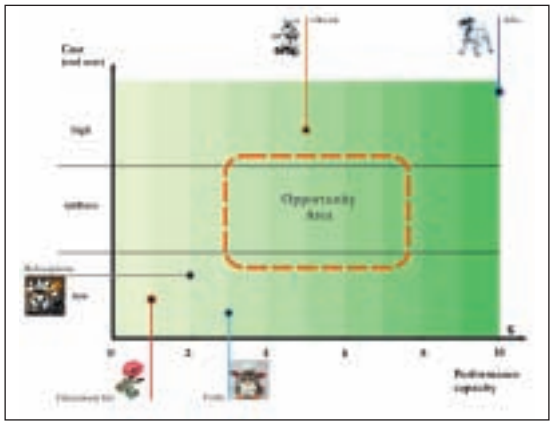
Fabrizio Giordano, took care of sensor frame and controller interfacing for the robot.

Davide Mazza, managed the software for the controller programming in the project.

1 *Partner companies participating in the project*

2 *Target of the project*

3 *Opportunity area of FLOrobot project*



UNDERSTANDING THE PROBLEM

TThe A.Mo.Ro.S.A. project includes different fields of application, e.g. surveillance, cleaning, gardening, impaired people support as well as entertainment.

In the last few years the market for robotic entertainment has rapidly grown and the rising trend is expected to remain constant in the near future, going from one million present units to estimated 2.5 millions by the end of 2009. The sales value is estimated to be over $4.4 billion (source: IFR Statistic Department 2005).

As the the field is so promising, we opted for the development of an autonomous entertainment system. Of all the existing concept ideas, FLOrobot stuck out as the best idea for technological innovation and possible market broadness.

Thanks to its numerous functions, FLOrobot is addressed to several groups of users, such as those who desire an alternative to traditional barometers and prefer an entertainment and furniture product. It could also be an appealing environmental enhancer in public places (hotel halls, airports, etc.).

EXPLORING THE OPPORTUNITIES

Based on a consumer market analysis, the entertainment robots segment can be divided into two main groups. The first consists of low-cost educational kits and toys, all with limited performance capacity, such as Furby® by Hasbro®. The second group consists of hi-tech toys characterized by high performance and high cost, such as Aibo® by Sony®. FLOrobot is an in-between product, providing good performance at a reasonable price. Through the implementation of new features allowed by its modularity, FLOrobot has the possibility of reaching higher market levels as well.

The choices we made especially concern the customer's target and the number and type of features, which added a series of constraints to the project:

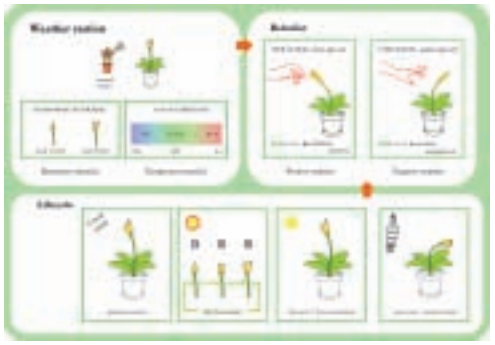
- weight and dimensions of the structure should be similar to those of a real flower
- easy mechanical solutions
- dramatically reduced number of sensors and actuators
- continuous fluid movement.

These constraints represent a challenge, specifically for what concerns the stem and the flower movement, the input-output control devices and their interfaces.

GENERATING A SOLUTION

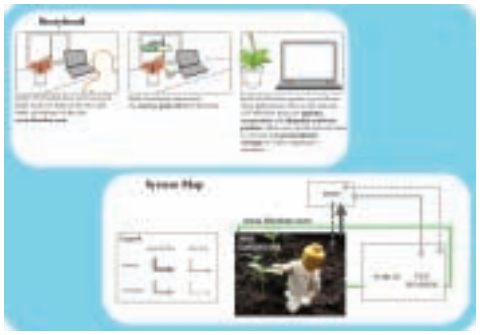
The robot unit behaves like a typical apartment plant with its requirements and lifecycle. The common requirements of a plant are: light, water and user's care. The water demand is simulated through the progressive exhaustion of the batteries and the consequent electricity requirement, while the lifecycle is represented by the daily blossoming and withering of the flower.

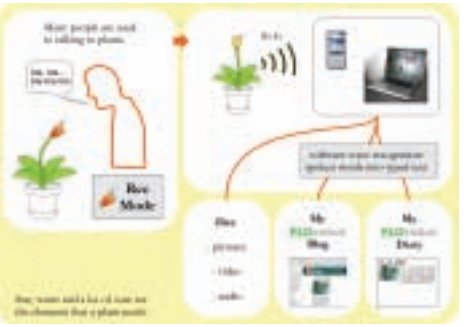
As the system gets started, the plant shows a positive state by seeking



4 *Tamagotchi FLOrobot and weather station*

5 *FLOrobot Community*





7 *FLOrobot MomentKeeper*

6 *FLOrobot Indoor Surveillance*

contact with the user, who in turn can interact with it both through touch and voice. If it is neglected, a negative mode becomes increasingly apparent: the plant lowers its leaves, closes petals and turns to a specific colour. In order to get the plant back to a positive mode, the user must show more affection, taking care of its primary needs, talking to it and approaching it slowly. In fact, approaching it slowly, the user will make the plant to be attracted by him/her. If, on the other hand, the plant is approached too quickly it will react as if threatened and will try to avoid the user, moving away from him/her. After a defined lapse of time during which the plant remains in the negative mode, a terminal state is reached: FLOrobot virtually dies and will remain in this state until the user resets it. Moreover, all the results of the user-plant interactions are influenced by the weather conditions: if the weather is fine the positive mode will last longer and will be easier to reach. On the contrary, if the weather is bad, this will act as an obstacle for the user trying to make the plant reach its positive mode.

As to the weather forecast, the basic variables evaluated by FLOrobot are external temperature and pressure (barometric function), that are expressed by the plant's behaviour through the leaves inclination (high, medium, low) and colour, the blossoming level of the flower and the stem position.

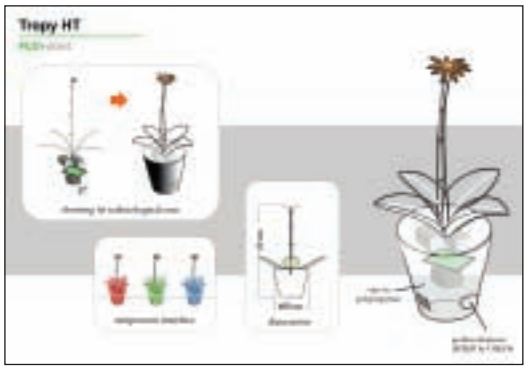
The robot main elements are: sensors, actuators and central computing unit.

Sensors

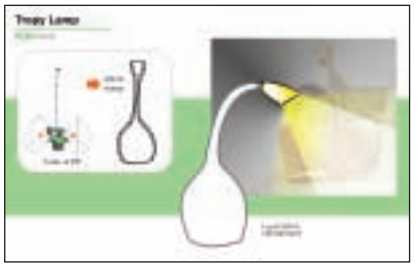
- Capacitive proximity sensors. The value of the capacity changes according to the variation of distance between the sensor and the incoming object.
- Luminosity sensors, set to detect the luminosity of the surrounding environment.
- Acoustic sensors, microphones used to determine the presence of music or voices.
- Temperature and pressure sensors, used to discern the different weather conditions.

Actuators The leaves, the stem and the flower are the moving parts of the device. The actuators that will be employed are the folowing:

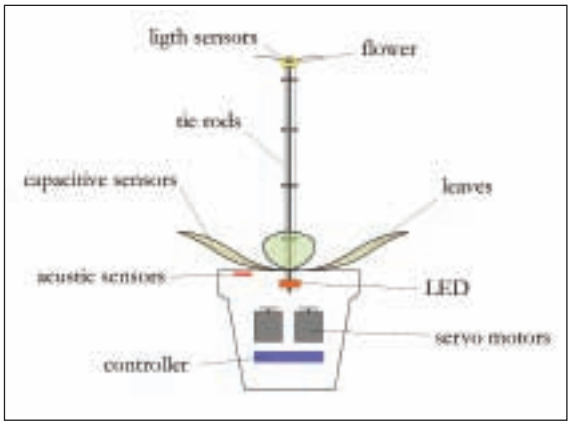
- Tie rods for the stem. The stem movement is obtained by flexing its upper end thanks to the presence of four connecting rods that run in parallel with the main structure.
- Tie rods for the leaves. The movement is obtained by traction and release of the leaves, following a procedure similar to the one described for the stem.
- Flower motor. The opening and closing of the flower is obtained through two additional motors in the bulb.



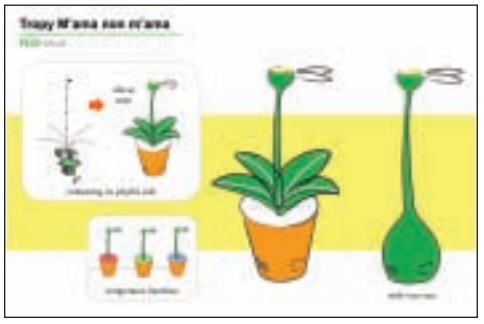
8 *A product development: TROPY HT*



10 *A product development: TROPY Lamp*



11 *Section of the robot*



9 *A product development: TROPY M'ama non m'ama*

Additional elements:

Light A series of LegoLED® FlexiLED® strips and RGB Led by Crosspoint, positioned inside the flower and under the leaves, assure the capacity to implement the play of light linked to both the charging mode and the different weather induced behaviours.

Perfume The air freshener by Oikos Fragrances, based on SFR® patent (Solid Fragrance Release), will be inserted in the plant too, enabling FLOrobot to release perfume according to a standard routine and the user's interaction.

FUTURE DEVELOPMENT

Different products through flexibility Due to the innovative modularity, three different products can be developed starting from the same core:

- Tropy HT: the internal structure of the device is displayed.
- Tropy LAMP: thanks to a high luminosity led the plant becomes a mobile lamp.
- Tropy 'M'ama non M'ama': emphasizes the playful side of the robot.

Scenarios:

- Tamagotchi FLOrobot and Weather Station
- FLOrobot Community
- FLOrobot Moment Keeper
- FLOrobot Indoor Surveillance

Central Computing Unit The plant's biorhythm (blossoming, withering) is modelled through finite state automata. The movement of the plant , according to the user's actions, is regulated by an algorithm. It allows the identification of the "intruder's" position through the sensors and the transmission of a series of commands to the actuators, in order to generate movements following a specific pattern. A PIC processor is enough to execute the required algorithm.
For what concerns the weather forecasting function, the outdoor sensors transmit their values to the plant through a wireless connection. Weather conditions are communicated to the user through the colours and positions that the plant takes.

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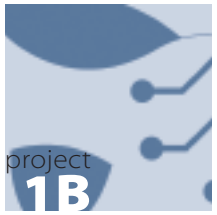


IERoKi
Innovative Entertainment Robot for Kids

ABSTRACT

With this project we entered for the first time in the world of entertainment with a different perspective, that is not as customers, but as creative designers and engineers. We proposed and realized a new toy, that we expect to become a success among young kids. For this reason, we decided to write this article in a different way, compared to the engineering books we have studied so far in our university courses. It is Christmas morning and a child is opening his presents. His eyes shine discovering that he received the toy he has desired for so long: caterBOT, his favourite character from the IERoKi series. It looks like a thirty-centimetre long caterpillar, with a green plastic body and four wheels fixed to the base.

The packaging contains some green plastic leaves too. In less than a minute the child places them on the floor next to the caterBOT and turns it on. The toy starts moving towards the closest leaf, passes over it and turns left. After detecting the second one, the caterpillar changes its direction and once it has reached the new leaf, it lights up. Leaves act as signals and can be placed freely on the floor. Their position can be changed also while the caterpillar is moving. Not only the toy looks nice, but it also shows many nice features: it can play sounds, switch its colourful lights on, and, of course, follow the instructions it receives from the child through the signals. It can turn right and left; it can speed up and even stop as long as the button placed on the rear is kept pushed. The toy name is IERoKi, an acronym for Innovative Entertainment Robot for Kids. The toy presents autonomous behaviours – no external direct command is needed: it moves on the floor as if an invisible hand guides it!

All this is possible thanks to the use of RFID, a wireless technology that enables the identification of a tag through the use of electromagnetic waves. In fact, the caterpillar shell hides an antenna beneath it, which can detect the so-called RFID tags contained in the leaves. Tags have been previously endowed with an identification code, so that after they are activated by the electromagnetic field of the reader antenna, the toy can identify them. This information is processed by a microcontroller, which commands accordingly the movement, the lights and the loudspeaker of the toy.

TASKS & SKILLS

Raouf Barboza was responsible for all the hardware components of the project, optimizing problems related to the interfacing among the different electronic devices.

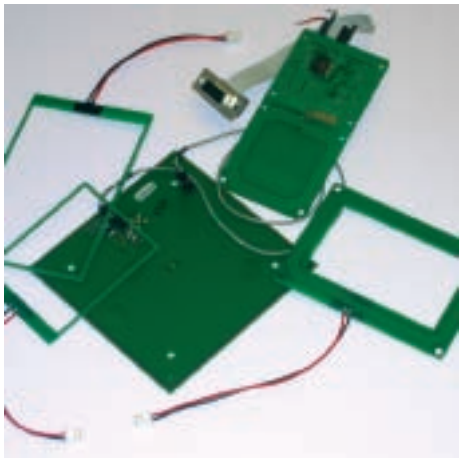
Luisella Borra took care of product ergonomics and usability, designed the mechanical structure and the external shell of the toy.

Maria Beatrice Criniti gathered information about the state of the art and legal discipline relevant to the technologies adopted in the project, moreover she supervised almost all the components buying activities.

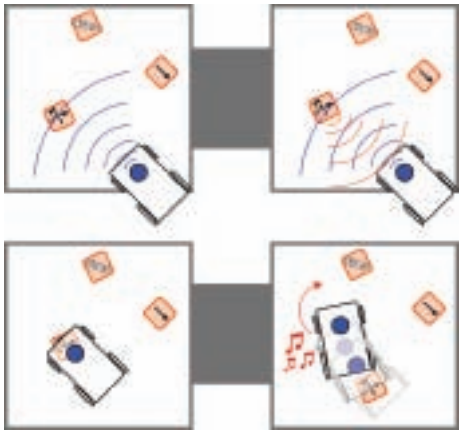
Luigi Malagò designed and implemented the firmware for the microcontroller and defined the overall software and hardware architecture of the toy.

Marco Rossi was responsible for internal coordination, economic project analysis and document editing.

1 *Concept scenario*



2 *RFID antenna and transponders*



3 *Description of the robot functionalities*

UNDERSTANDING THE PROBLEM

Imagine five students taking part in an adventure. They don't know each other, speak different languages and even come from different continents. It is not a pleasure holiday on a Caribbean island, but a two-year long trip bristling with troubles, difficulties and problems students have to face.

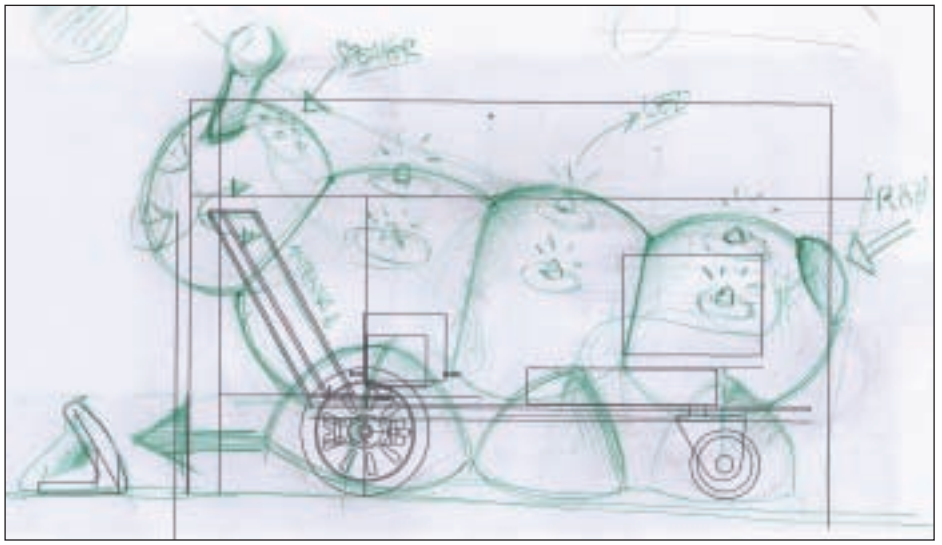
We love this comparison because it best reflects our experience in this project. We had to realize an autonomous mobile robot for services applications, summarized by the acronym AmoRoSA, which was the name of our project. We were even given a series of constraints our robot had to respect, in particular flexibility, modularity, usability, market orientation and, last but not least, innovation: our robot would have to be different from already existing devices, in terms of functionalities and technologies.

After having understood the meaning of all these concepts, we organized several brainstorming sessions. Once a sufficiently rich list of ideas was obtained, we assessed them with our tutor's support. Finally, we set the field of our project: children entertainment.

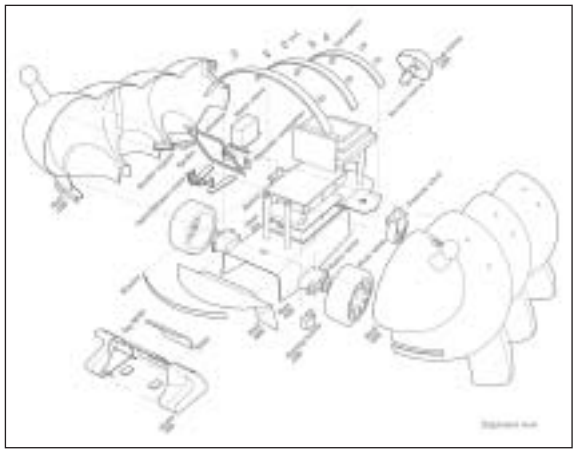
EXPLORING THE ALTERNATIVES

We conducted a market analysis to realize which technologies, strategic positioning and tendencies characterized the existing products. At first we tried to understand how entertainment robotics evolved in the last decades. Through many researches on the Internet and product catalogues released by entertainment companies, we identified today's most successful products. We tried to assess them based on two variables: selling price and performances. After mapping this information in a simple performance-price chart, we identified the market segments and products positioning. This state-of the-art analysis concluded with the study of market trends, in order to judge the profitability of the field we were about to enter. We analyzed entertainment robot market past trends in terms of value and units sold, considering in the end experts' expectations about the future evolution.

Basically, we wanted to provide children with a toy that could possibly fulfill their expectations, and attract their attention as long as possible. In order to achieve this goal we adopted a sort of stage-gate approach. Actually our project evolution was not as linear as it appears from the previous description. In fact it was characterized by several loops arising from unexpected troubles and even from the



4 *First drawing of the external shell*



5 *Exploded view of the toy*

better understanding of aspects related to children behavior. Another great issue was related to the impossibility of implementing some chosen technologies, owing to the lack of specific competencies of the team. During the early project stages, for example, we decided, for several reasons, to change repeatedly the size of the toy and the technologies to be used in order to better interact with the external environment.

GENERATING A SOLUTION

We decided to explore and bring forward two different solutions, which seemed to be equally interesting. The first one was an autonomous racing car moving along a circuit build up in a domestic room with standard modules to be assembled by the child. In our scenario the car would be able to follow the path thanks to the on-board sensors, register it and then compete in the same circuit against another racing car guided by a child through a radio controller.

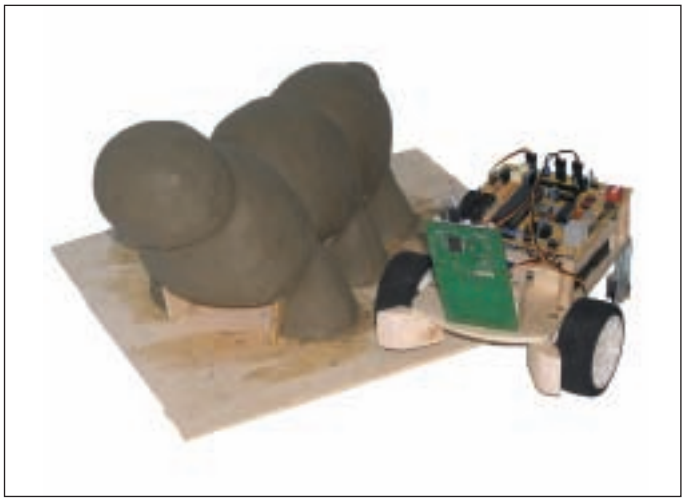
In our mind this toy fulfilled many of the project requirements such as flexibility, innovation and, of course, autonomy. On the other hand we identified some problems, in particular those concerning technological aspects of the robotic device. Besides the technological difficulties related to the significant speed the car was required to sustain, there was the threat that some potential consumers could be prevented from buying it owing to limited indoor available spaces.

The second best solution consisted in a sort of small train able to follow a line freely drawn by the child on a floor or on other surfaces. This idea was characterized by a lower speed compared to the previous one; as a consequence, the toy resulted more suitable for younger users. The child could paint some signals along the path to be recognized by the toy. We were able to identify some difficulties related to the choice of the support on which drawing the line or to the correct identification of the signals.

Owing to these critical and serious aspects common to both solutions, we decided to interface directly with the children world. We organized a meeting with two experts in the field of youth entertainment, in order to integrate information we collected previously from books and manuals. One of the most important contributions they gave us concerned the limits associated with a two-dimensional game environment. They provided enough information for us to conclude that the toy train was not completely able to represent a good source

6 *Electronic components on the control board*

7 *Final rendering of caterBOT with external markers*



8 *Prototype of the robotic base with the RFID antenna and model of shell*

of fun for our target users. We decided also to discard even the racing car toy because, after having consulted our academic and external tutors, we realized that the technological problems we would have to face were far beyond the reach of this project.

In order to change our approach towards a three-dimensional game we needed a technology that could let our toy identify an object in a three dimensional space. We chose RFID, a technology widely used but rarely applied in the entertainment field.

The game standard scenario is very simple and will be now briefly described. The toy moves in a domestic environment thanks to two driving wheels. While moving, it is able to use a RFID antenna as a kind of radar, in order to detect tags in the nearby. Tags are contained in signals that can be freely placed by the child on the floor, for example forming a path along which the toy will move. To each RFID tag a specific identification code is associated, so that when the toy recognizes it, this will behave accordingly. The toy is able to perform some basic actions: it turns left/right, plays sounds, and so on.

Moreover, the toy can implement several higher level behaviors: most of them will depend on the specific external shape that will be delivered. Besides caterBOT, different versions of the toy have been conceived. For example, the same device could be easily adapted to behave as learnBOT, the personal teacher helping children to learn a foreign language or fableBOT, a friend telling a new story according to the sequence of the events created by the child with the markers.

The software and hardware architecture of the toy have been designed in order to be as much modular as possible: for this reason, not only different behaviors can be easily implemented, but also can be extended to other types of toys.

Finally, we also prepared a business plan like we had gotten into partnership with our project tutors. Due to a series of economic reasons, we supposed to sell our robot to kindergartens with the help of a couple of agents and through a web site. We considered lot of aspects: production site choice, production techniques, delivery strategy, cost analysis and marketing strategy. After computing the best selling price through benchmarking and mark up techniques, we supported qualitative considerations with an estimation of cash flows. For what concerns the first three years, with our given assumptions we estimated a positive profit since the second half of the second year.

Flobe
A veritable robotic lamp

ABSTRACT

Light is a complete sensorial experience that brings man to acquire a continuous new perception of the surrounding world. Light is an element in motion: difficult to describe, it is partly natural and partly man made.

Let's try to imagine to enter in a very dark room that is like a black cube that chokes and oppresses us, concealing its perception. Suddenly a metal rustle signals us the presence of a fast rotation movement. After this, a second noise arises: something is moving. LIGHT. The cube is shining with an ivory light, a pure and clean light that surrounds us and draws our attention to its point of origin. In the middle of the ceiling there's a strange object shaped like a flower. It's our lamp. The robot-lamp is formed by six petals and a central bulb able to sense the lightness condition of the room and adequate its intensity and light direction according to the user's needs. However, due to the nature of the light, the lamp mutates continuously just like a real robot that develops its potential to help its master. The central bulb, the eye of Medusa that turns everything into stone, with its well-balanced light intensity, is vertically moving to the bottom. A sphere made up with two materials, hanging from three cables, falls into the master's hands waiting for it. With a fluid movement it detaches from the mother that gave birth to it. Now the game starts. Half of this little portable sphere is made up with a material that can be manipulated, assuring an adequate volume of the sphere in any condition. Its lightness, dimensions and tactility tempt the user to play with it and to bring it with him/herself. The sphere is a three leds lamp that is autonomous and can be placed in the main lamp at user's will.

The dream we want to give is based on the simplicity of managing - by ourselves and by the robot - the light that follows our day. Sometimes the lamp lights correctly the cube, other times we take the lighting sphere in our hands…

TASKS & SKILLS

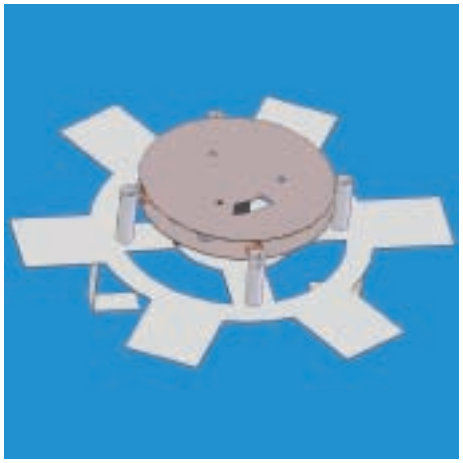
Claudio Roncuzzi, experienced in materials, took care of the selection of adequate materials.

Carlo Ballerini competence lies in two fields of research: automotive industry and renewable energies. He worked on lamp architecture and actuation components.

Luca Frasson, interested in development of strategies and devices for rehabilitation, focused on technical aspects and user's requirements.

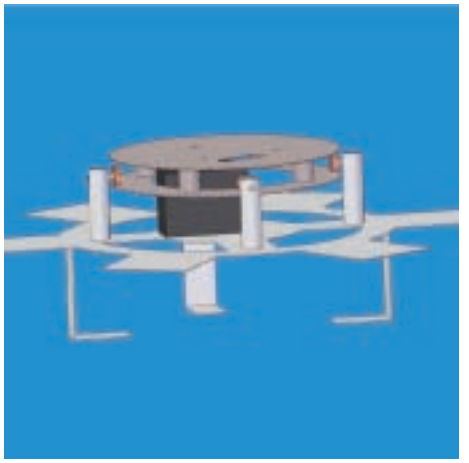
Tatiana Chierici was responsible for the state-of-the-art, metaproject, project scenery and ergonomic components.

Diego Quadrelli was responsible for design, light characteristics, dialog between lamp and room and coordination of the prototype.



1 *The internal chassis of the lamp consists in two main parts. The brown one is fixed to the ceiling, while the white one can rotate along with all the lamp. Its function is supporting all the internal components such as LEDs, servomotors, PICAXE, thanks to its six external appendixes, one for each petal of the lamp*

2 *A side view of the chassis. The black element visible inside is the servomotor which makes the lamp rotate around a vertical axe. In doing so it is assisted by four small wheels (orange-coloured in the picture), rolling on the bottom ring of the brown element. The three consoles on the bottom of the rotating part support servomotors which make the sphere go up and down to/from the celing from/to the user*

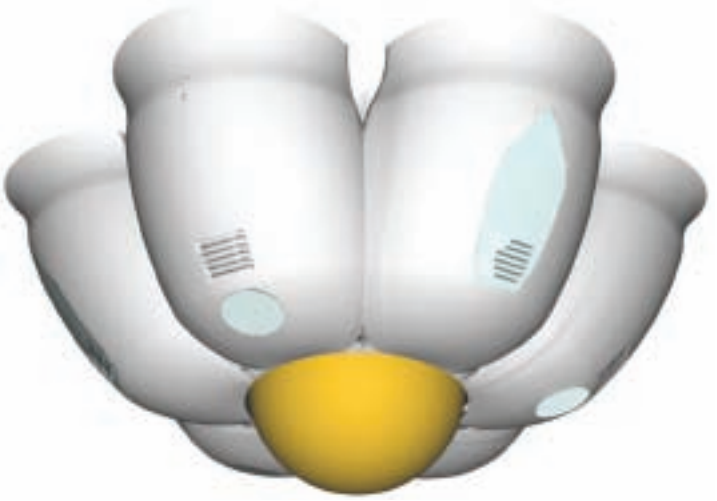


3 *Some of the components of the robo-lamp. On the bottom the microcontroller PICAXE is recognisable: it is the real "brain" of the robot. This element receives data from light sensors and drives all the servomotors to achieve the required performances*

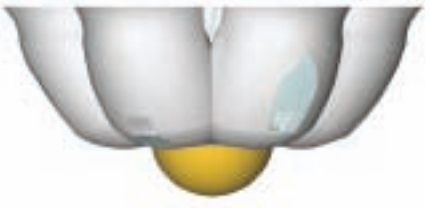
FEATURES AND USE

A typical object necessary for our lives is revised from an innovative and imaginative perspective: a lamp, a robotic lamp.
This lamp lives in the house, in the middle of the living-room ceiling. It interprets and determines the surrounding environment in an autonomous and intelligent way. This lamp is able to understand what happens in the room: if someone enters the room or if the room is empty, if it is becoming dark or there is too much light. It learns and knows the habits of the people living in the house and interacts with them singing and lighting when required. The robo-lamp can also give birth to another portable and fun spherical lamp which can be placed wherever the user desires to light up the room around it.
This robo-lamp can be used in different kinds of room and with different kinds of furniture; it will fascinate any perspective buyer, but its target user is a sophisticated consumer, really interested in high and refined technology and passionately fond of curious technical and intelligent objects. This robo-lamp would become a 'status symbol' because of its particular oddity and its strong impact.
The robo-lamp has, under certain aspects, the appearance of a flower, with six petals including leds, sensors and speakers. It is able to move to light up the place where people stand or where there's no or scarce light. In the middle of the flower there is the spherical lamp, which, when required, can descend from the ceiling to welcome with light and music everyone enters the room and can be also taken off to be manipulated and placed somewhere else.
We decided to develop the idea of this lamp, because we thought that a smart element at the core of the house was needed: the oven is intelligent, the fridge is intelligent, the shower is intelligent and now also the lamp is. Moreover, this idea match the interests of Microsystem and Interactive Toys, the two companies joined in the Amorosa

4 *The robo-lamp has several light sources, both in the part fixed on the ceiling and in the spherical lamp. Here some of the LEDs used are shown: their colours can vary, depending on user's requirements. In general, white and amber lights dominate, but in spherical lamp other colours can be applied as well*



5 *The lamp cover, whose shape aims to remind of a flower, with its six petals. The lamp, here shown as a daisy, has two different light sources for each petal. The first is located on the bottom and has a round shape, while the second one ha a drop-like shape. This light source can be freely oriented to illuminate the room better and concentrate the light where necessary*



6 *This side view of the cover highlights the position of the two different light sources and shows also the spherical central component of the lamp. Its function is including the mobile part, which represents the ludic and more versatile aspect of the robot. Even though the robot is not too small, its impact in the interior is quite soft, because it seems a flower rising from the ceiling*

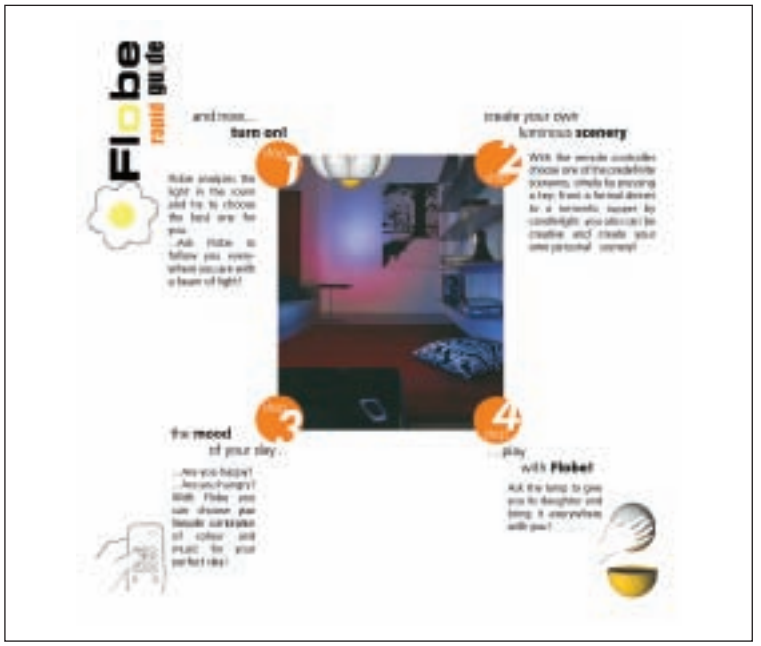
project, in the development of new intelligent ad useful products which can also be appreciated for their usability and sophisticated design.

The lamp, being also a robot, has different sensors for the detection of ambient light (photo diodes) and infrared sensors for the detection of human presence in the room; these sensor are cheaper compared with video systems though, with an adequate image processing, the video system can better understand what happens in the room.

Light is assured by small moving leds, with different colours and with different angles of lighting; leds are very small and powerful, if compared with incandescent light bulb, and they also show low power consumption.

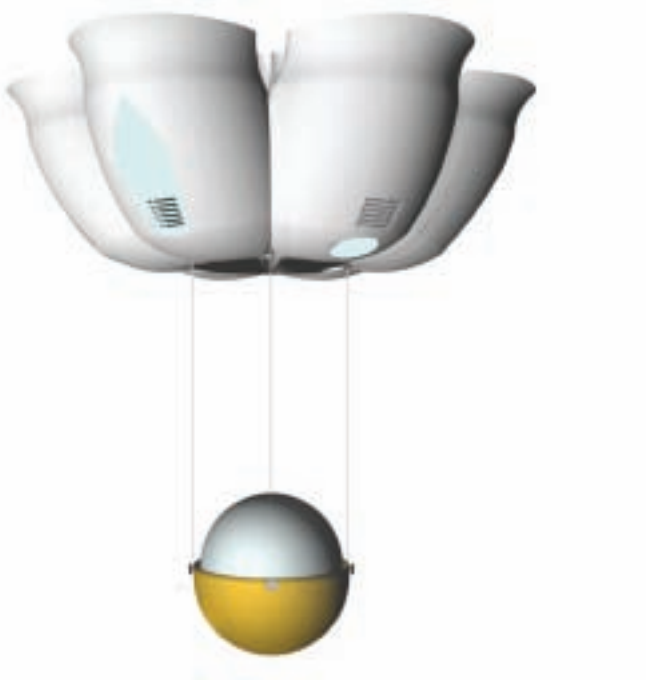
The robo-lamp can rotate on its own axis and can push one of its petals far from the centre of the room, being able to light with narrow beams the place where, for example, a person is reading. Also the spherical lamp can move and, in this way, it expresses emotions with its movements of light.

The robo-lamp can also be controlled by an infrared remote control that can be used as a joystick to move the beams of the lamp, and also as a computer for the programming of some behaviours of the lamp: actually it is possible to configure different settings of illumination for different contexts (for instance while watching a film, reading, dining with the fiancée, lunching with friends…) and to save them in the memory of the intelligent part of the lamp. The lamp can also remember particular dates, such as birthdays, playing music for the



7 *Flobe rapid guide*

8 *Here the two parts of the robo-lamp are shown. The spherical lamp is able to get up and down to/from the part fixed to the ceiling. The user can take and bring it wherever he desires in the room. Because of the peculiar material it is made of, the spherical lamp can be manipulated to be placed on any surface (desk, floor, bedside table, the back of an armchair, etc).*



person who is to be celebrated. Music can be loaded in the lamp in mp3 format.

The intelligence of the robo-lamp is achieved through powerful microcontrollers able to process all the different data coming from the remote control, the sensors and the inner calendar, in order to answer to these inputs with suitable different illuminations, movements and music, creating different atmospheres.

The robo-lamp needs to be programmed the first time it is used with a personal computer that, thanks to a particular software, is able to set up the best settings for the particular room where the lamp is installed. The software can also be used for further setting changes that are not very simple to carry out with the remote control, for example when the user decides to move the furniture.