Departamento de Engenharia Electrotécnica
Instituto Superior de Engenharia do Porto

Final Report

European Project Semester 2012

An interactive sound table

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Contents

List of tables:

List of graphs:

List of figures:

ABSTRACT

Interactive products are appealing objects in a technology-driven society and the offer in the market is wide and varied. Most of the already existing interactive products only provide experience with light or sound separately. Therefore we aimed to develop a product that would combine both features. We decided to take a new approach and create a product which has not yet appeared in the market. We have chosen to connect entertaining features with a common coffee table. One may find itself in an innovative, magic world while experiencing the light and sounds given off by the table. The table can be thought of as being at the cutting edge of technology as it may change the way we perceive stimuli and sharpen our senses.

A NOTE ABOUT THE TEAM

Four people: Izabela- a Polish girl, Maria- a Spanish girl, Toma- a Lithuanian girl, Aare- an Estonian guy connected to one team at the European Project Semester 2012 in Porto. Each of member of the team is from a different country, university, and of course they have a different knowledge background, but they had worked together as a team using good communication. It wasn't very easy, because of their cultures and life experiences. What did they have in common? Only one thing, the same goal for four people! To make an interactive sound table together. They didn't know anything about how to make it, but they handled it. This report presents their work.

GLOSSARY

LED - Light Emitting Diode is a semiconductor light source. LEDs are used as indicator lamps in many devices and are increasingly used for other lighting.

Sensor - (also called detector) is a converter that measures a physical quantity and converts it into a signal which can be read by an observer or by an (today mostly electronic) instrument.

Interactive products - this kind of products allow you to communicate directly with them, they do things in reaction to your actions.

Nowadays life provides us with a wide range of possibilities in engineering life and these days we always hear about Conglobation. People from different countries, from different cultures can connect their knowledge and ideas quickly and easily. There are many international projects, forums to improve our engineering life. This way, four students from four different countries, universities, engineering specializations and of course, with different experiences and ideas got together.

1. INTRODUCTION

Our team specialization is the design and production of specific electronic products. The general mission is to show how we can apply technologies into a simple living-room table. We decided to build an interactive sound table. Our purpose is not just to design and build a product, but to make it for costumers. That table has to be attractive, available, usable and, finally, we have to produce and promote that like a new product in the market.

Our project involves different technical and social branches of science:

Technical:

- Electrotecnics – it now covers a range of subtopics including power, electronics, control systems and signal processing
- Physics – this is a natural science that involves study of matter and its motion through space-time with related concepts such as energy and force.
- Materials science – this scientific field investigates the relationship between the structure of materials at atomic or molecular scales and their macroscopic properties.

Social:

- Psychology – this sciencehas the immediate goal of understanding individuals and groups. In that way we have to understand what the people want.
- Economics – it involves the mud for analysing production, distribution and consumption of products.
- Communication - the activity of conveying information.
- Sociology – we have to build a strong team that will achieve the best result.

All these science fields are considered in our project and we have to keep the balance between them.

1.1. PROBLEM

Our tabletop is divided into 9 sections and each of them has one proximity sensor in the middle and four white LEDs. There is a different sound in each section. If hand or any other object that reflects infrared light is placed on top of one section then the LED lights turn on and it also makes sound or plays music. Light intensity depends on how close the object is to the table. The closer the hand, the brighter the table will be. The general problem is to create a system which will enable the nine sections to work independently, but having a smooth transition from one to another.

1.2. MOTIVATION

There are lots of possibilities in this technological age. We are using different things of electronics; therefore our purpose is that people could enjoy the technologies in daily life. We are young engineers, so we want to find a way to make our flat more interesting.

1.3. OBJECTIVES

The main objective of our project is to build an interactive sound table using a simple coffee table. The table can give an innovative magic world through sound and light. It will make it possible to widen your senses and it will be a symbol of technological development.

1.4. EXPECTED RESULTS

When you use an interactive sound table you can change the music field, sound volume and light brightness with simple hand movement. We expect that our product will cooperate with people.

1.5. REPORT STRUCTURE

In this report we describe the main operation principles, materials chosen and general problems. The marketing plan and sustainable development problems are also explained. The project development is thoroughly detailed and we close up the report with some discussion remarks on the project achievements and with suggestions for future developments.

1.6. TABLE OF TASKS

On the following Table (Table 1) the division of tasks between the team members is detailed.

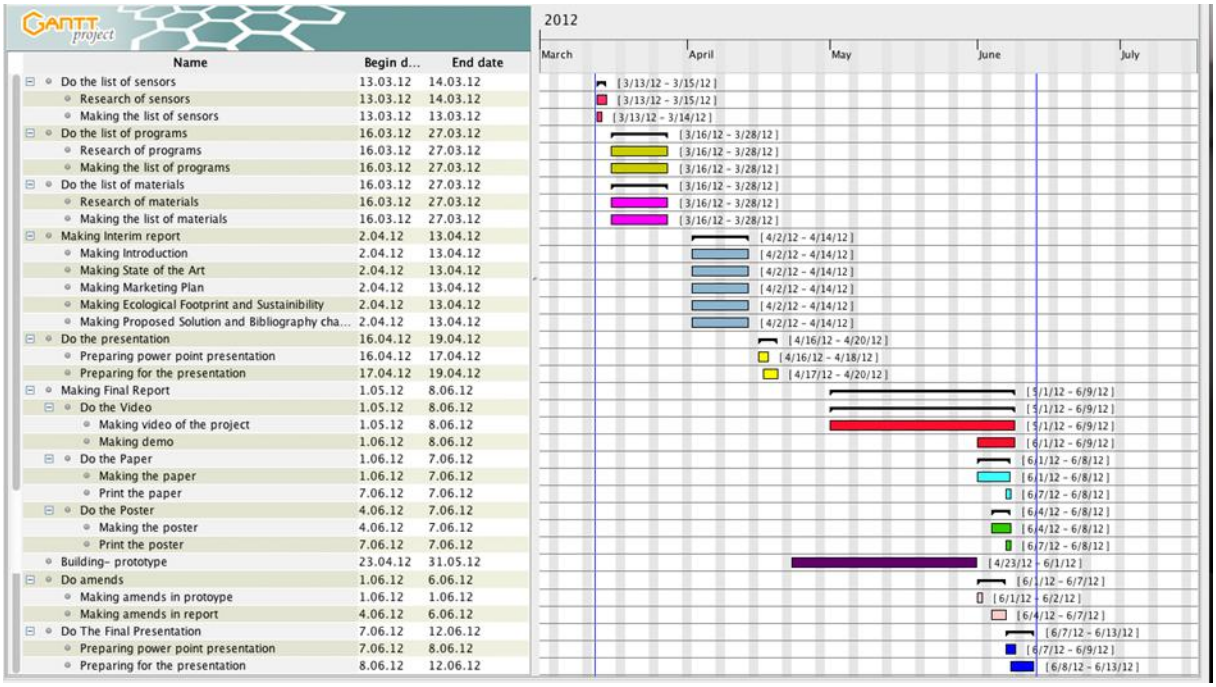
Table 1 Table of tasks

Task	Who
Research of sensors	Aare, Toma, Iza, Maria
Making the list of sensors	Aare, Toma
Research of programs	Aare, Toma, Iza, Maria
Making the list of programs	Aare, Toma
Research of materials	Aare, Toma, Iza, Maria

Making the list of materials	Aare, Toma
Making Introduction	Toma
Making State of The Art	Aare
Making Marketing Plan	Iza
Making Ecological Footprint and Sustainability	Iza, Maria
Making Proposed Solution and Bibliography chart	Aare, Toma, Iza, Maria
Making Power Point Presentation	Maria, Toma, Iza, Aare
Preparing for Presentation	Aare, Toma, Iza, Maria
Making Video	Aare, Toma, Iza, Maria
Making Demo	Toma
Making the paper	Iza
Building prototype	Aare, Toma, Iza, Maria
Making poster	Toma, Maria
Making User Manual	Aare
Making Power Point Final Presentation	Maria
Preparing for the presentation	Aare, Toma, Iza, Maria

1.7. GANTT CHART

The Gantt Chart systematizes all the project management procedure. This is presented on Graph 1 below.



Graph 1 Gantt Chart

2. STATE OF THE ART

We all know that there are lots of different possibilities to design and make any product. The general problem was our decision – how to get the best option. An interactive sound table is a product where there is an entertaining feature added to an ordinary furniture. Currently, there are several products which are quite similar, but they don't have sound, so we have got something innovative. There are two types of interactive tables: tables which have a multi touch LCD display and tables with infrared sensors and led lights. The multi touch LCD display table can have many different usages. It can be used as a computer touch screen monitor and you can display there everything, but on the table with led lights you can make different lights and some simple patterns. The biggest advantage of LED light tables is that they are much cheaper to build, so for our project we have chosen LED light table as the best option for our university (when we consider the budget) and for us (when we take into account our interest).

2.1. RELATED PROJECTS AND PRODUCTS

We have found two products which are closely related to our product.

First one is an Interactive LED coffee table called "The Wave" (figure 1), created by the custom design studio Because We Can in Oakland, California.

The table, costing approximately $2,200, has 480 bright LED lights, along with 32 infrared optical sensors. A circuit board is embedded inside each table, allowing the infrared sensors to detect any object passing over a cloud of light hovering above the table. The LEDs react to any motion occurring at 60 cm above the surface.

Figure 1 Interactive LED coffee table called "The Wave"[1]

The second product is Microsoft's touch-screen tabletop PC called "Surface" (figure 2). Microsoft Surface sees and responds to touch and real world objects and supports more than 50 simultaneous inputs. Microsoft Surface is a commercial computing platform that enables people to use touch and real world objects to share digital content at the same time. It can be used as a table, on the wall, or it can be built in other types of furniture.

[1] http://www.evilmadscientist.com/article.php/tablekits

Figure 2 Microsoft's touch-screen tabletop PC called "Surface"[2]

2.2. TECHNOLOGIES

2.2.1. Light Emitting Diodes

Light-Emitting Diodes (LED) in essence is a P-N junction solid-state semiconductor diode that emits light when a current is applied through the device. By scientific definition, it is a solid-state device that controls current without the deficiency of having heated filaments.

[2] http://www.tech-blog.pl/2008/03/31/microsoft-surface-w-2011-roku-albo-wczesniej/

How does a LED work? White LEDs ordinarily need 3.6 V of Direct Current (DC) and use approximately 30 mA of current and have a power dissipation of approximately 100 mW. The positive power is connected to one side of the LED semiconductor through the anode and a whisker and the other side of the semiconductor is attached to the top of the anvil or the negative power lead (cathode). It is the chemical composition or makeup of the LED semiconductor that determines the color of the light that the LED produces as well as the intensity level. The epoxy resin enclosure allows most of the light to escape from the elements and protects the LED making it virtually indestructible. Furthermore, a light-emitting diode does not have any moving parts, which makes the device extremely resistant to damage due to vibration and shocks. These characteristics make it ideal for purposes that demand reliability and strength. LEDs therefore can be deemed invulnerable to catastrophic failure when operated within design parameters.

Figure 3 shows a typical traditional indicator LED. Traditional indicator LEDs utilize a small LED semiconductor chip that is mounted on a reflector cup also known as the anvil, on a lead-frame (whisker).This whole configuration is encased in epoxy which also serves the purpose of a lens. LEDs have very high thermal resistance with upwards of 200 K/W.

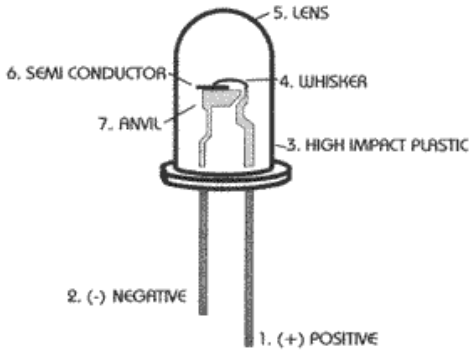


Figure 3 A typical traditional indicator LED[3]

[3] http://www.merg.org.uk/merg_resources/led.php

2.2.2. Proximity sensors

Ultrasonic Distance Sensor

Ultrasonic sensors work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object. This technology can be used for measuring wind speed and direction (anemometer), fullness of a tank and speed through air or water. For measuring speed or direction a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water. To measure the amount of liquid in a tank, the sensor measures the distance to the surface of the fluid. Further applications include humidifiers, sonar, medical ultrasonography, burglar alarms and non-destructive testing. Systems typically use a transducer which generates sound waves in the ultrasonic range, above 18 kHz, by turning electrical energy into sound, then upon receiving the echo convert the sound waves into electrical energy that can be measured and displayed.

Infrared Proximity Sensor

In Sharp infrared proximity sensor the distance will only be measured or judged by the reflected angle of the light using a triangular measurement principle (figure 4). Sharp infra red proximity sensor has an IR led, that emits narrow beam. Beam that has reflected from some object is directed through the lens on the position-sensitive detector (PSD). PSD conduction depends on the beam position. A small CPU will calculate the result into a specified output which reflects a specific measured distance.

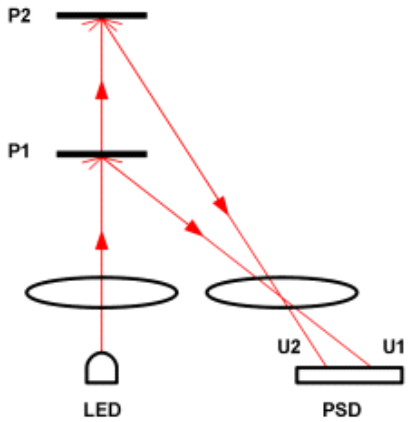


Figure 4 Triangulation[4]

Figure 5 presents the Analog Output Voltage vs. the distance to Reflective Object.[5]

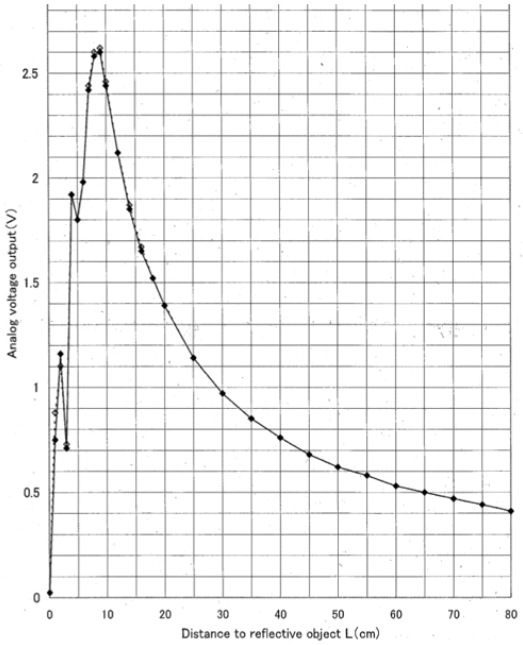


Figure 5 Analog Output Voltage *vs.* Distance to Reflective Object

[4] http://www.gurulib.com/_project/sharp_gp2d02/sharp_gp2d02_infrared_ranger.htm

[5] http://www.sparkfun.com/products/242

2.2.3. Arduino Platform

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments. Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). Arduino projects can be stand-alone or they can communicate with software running on a computer (*e.g.* Flash, Processing, MaxMSP). The boards can be built by hand or purchased preassembled; the software can be downloaded for free. The hardware reference designs (CAD files) are available under an open-source license.

2.3. CONCLUSIONS

We decided to build an interactive table with infrared proximity sensors and led lights, because it is cheaper and easier to build. We are going to use infrared proximity sensor because we want to cover the table with glass and ultrasonic sensors don’t work through it. Besides that infrared sensors have a lower price. For lightning we are going to use led lights because we need lights to light up immediately, not to warm up first like regular light bulb. Sensors, lightning and sound are controlled through Arduino Mega 2560. Our tabletop is going to be divided into 9 sections and each of them has one proximity sensor in the middle and 4 white LEDs. Each section holds one sound or music. If a hand or any other object, reflecting infrared light is placed on top of one section, then the LEDs turn on and sound or music is heard. Light intensity depends on how close the object is to the table. The closer the hand, the brighter the table will be.

3.MARKETING PLAN

3.1. EXECUTIVE SUMMARY

Marketing isn't just selling and advertising. In fact, aims of marketing are:

- to identify customers' needs
- meet those needs

Marketing is much more than single transactions: it is about building long lasting relationships with customers.

The most important aspects that build the marketing concept are:

- Customer´s satisfaction
- Profit
- Total company effort

Either way, the marketing plan is a blueprint for communicating the value of our products to our customers. This marketing plan illustrates our market segments and the strategies we are employing to get clients and create a solid revenue stream. We are not just any table developer. Our unique focus of creating tables with a news gives us an advantage over our competitors by giving customers a new outlet to enjoy their time with our product. This fills a real need of not just traditional tables but expands our reach to people who would normally not use tables like ours yet. In the first 3 years of the business, we expect selling to constitute a large portion of our revenue stream.

PRODUCT:

For young adults

Who would like to change their room

Modern piece of furniture

Which makes room more innovatory

Unlike old-fashioned gadgets

3.2. MARKET ENVIRONMENT ANALYSIS

Marketing environment includes:

- Microenvironment
- Macroenvironment

MICROENVIRONMENT:

- **Company's Internal Environment**- In this situation we don't have a company, but we can imagine that our company is our team. The team consists of four people. We can create our internal environment, how we can solve problems in our team, how we can deal with our work, etc. The most important will be to create our product as good as we can. Internal environment is not only place, it is also communication between people and rules, for instance.
- **Suppliers**- If we are thinking about resources that we need to produce our good, we should imagine that we are going to produce a lot of those products. Because it will be really hard to describe require materials from suppliers for only one product.

Currently, we are going to produce only one item, so our main client is ISEP, but supervisors are going to buy those things from different places (IKEA, via internet).

- **Marketing Intermediaries**- In this situation the main "company" that can help us to promote, sell, and distribute our good is ISEP. First of all we would like to find a company which will be producing our product, then we should think about a place where we can put it. We've got plans to find a furniture company that allows us to locate our product in their shops. Then when the product is more "famous" we will sell it via internet, so we have to set up a website or sell our product via www.ebay.com (for example).
- **Competitors**- There are few companies in the world selling products with similar properties as ours. We think that it is positive as it means that what we are going to produce is innovative and modern when compared to others in the market. So, in our opinion, competition is not so huge. Our advantage is that the table we are going to produce emits sounds, we haven't found anything like that. It is a new option for tables. Similar products are also addressed to different markets from the one we plan to our product. Their target market are also clubs. Our product is targeted at 20 to 35 year-old people, especially young adults who would like to change their rooms. With time we would like to enter to the clubs, bars, pubs.
- **Publics**- The target market for our product will be market for goods, because we are going to sell a table. Our product is targeted at 20 to 35 year-old people, especially young adults who would like to change their rooms. We would like to get clients, whose national average salary allows them to buy our product. The main characteristic of our shoppers will be crazy and modern people, who are able to change their environment using only one gadget. This product is for people who appreciate modern lifestyle and originality for an affordable price.

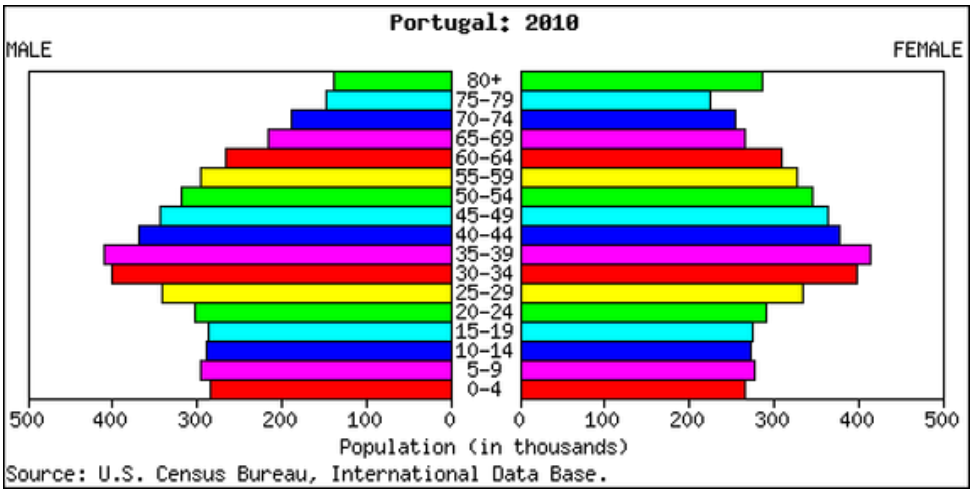
MACROENVIRONMENT:

- **Demographical**

Firstly, in this case our product will be available only in Portugal in furniture shops, the easiest way to buy. We did the research.

Age structure in Portugal in 2010 is of 65.8% (male 3,539,457/female 3,541,989) and the population growth rate in Portugal is of 0.212%.

As we can see in graph 2, there are many people with ages between 20-35 years-old.



Graph 2 Portugal Demographics in 2010[6]

Our product is targeted at 20 to 35 year-old people, so we think that it will be a good solution to start selling in Portugal. Some young adults live at home, others are college students or have joined the workforce in the last 10 years. We think that our product could interest teenagers, because they always want something which is for older people. We know that they don't have money to get products, so their parents will do it. Parents´ age could be around 30-40.

[6] http://www.nationmaster.com/country/po-portugal/Age-_distribution

We did the research in terms of "type of private household", shown in table 2:

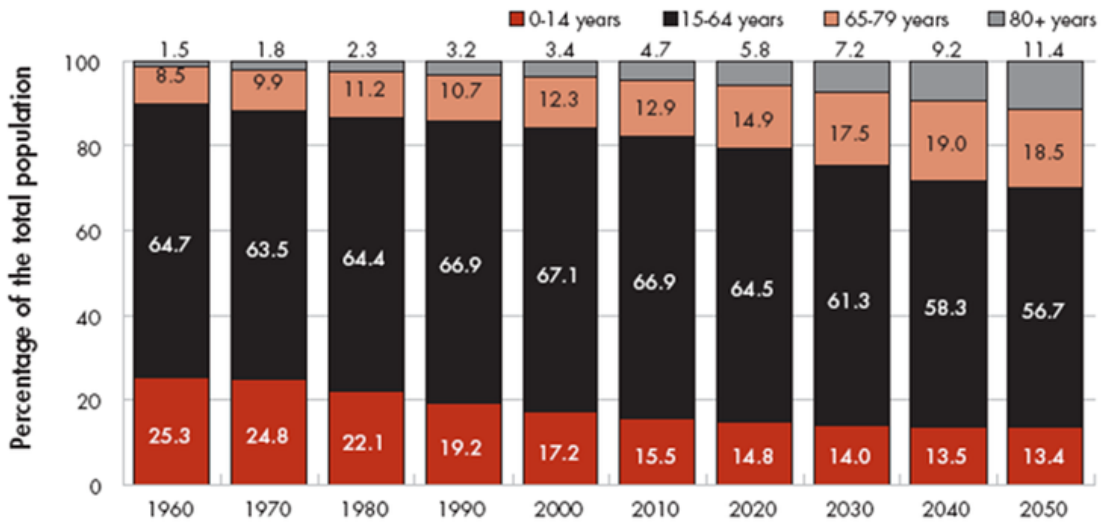
Table 2 Private households in Portugal (in thousands).[7]

YEARS	TYPE OF PRIVATE HOUSEHOLD IN PORTUGAL		
	1 individual (25-35)	Couple without children	Couple with children
2007	657.402	849.590	1600.969
2008	683.491	874.981	1571.114
2009	688.234	884.308	1572.312
2010	696.388	907.372	1560.602
2011	758.100	903.157	1532.466

As we can see in table 2 individual household is always growing up, it means that there are many people who live alone and we can sell them our product. If we look for household "couple without children", it grows up too, except in 2011 when we see a small decrease. We think that people who don't have children could be our clients too, because they are living together and our gadget will be something new in their flats. When it comes to household "couples with children", we see that it is falling down, but for us it is not bad news, because there are still a lot of them, so we don't have to worry about it.

[7] http://pordata.pt/en/Portugal/Private+households+total+and+by+household+type-19

In the future, we would like to expand sales into other countries. We are thinking of Europe, one country for one year. Except that we would like to sign contracts with furniture shops to place our product there. We did the research concerning European people, shown in graph 3.



Graph 3 Europe Demographics between 1960 – 2050.[8]

Analysing graph 3 we see that in 2010 there are 66,9% of people between 15-64 years of age. As we see, our product is addressed to those kind of people, so in Europe we won´t have problems in selling our good.

[8]: http://www.hrneurope.com/blog/?p=1957

We did research in terms of "private households in Europe" too:

Table 3 presents research on a variety of households from different European Origins. As we can see, there is an increase in individual and couple without children household similar to Portugal.

When we look at household "couple with children" we see a growth. It is different from Portugal; it means that when we enter the rest of the European market, we will have potential clients from this group.

Table 3 Private households in Europe (in thousands).[9]

YEARS	TYPE OF PRIVATE HOUSEHOLD IN EUROPE		
	1 individual (25-35)	Couple without children	Couple with children
2007	66164.5	47195.8	42285.0
2008	67157.7	49978.6	42674.1
2009	68394.6	49110.1	42750.4
2010		49792.5	43260.2

- **Economic**- First of all we have to think what economic environment means for us. In our opinion it is using the minimum of time or resources necessary for effectiveness. The economic environment consists of all factors-such as salary levels, credit trends, and pricing patterns, which affect the consumer´s spending habits and purchasing power. It is really important to take care of everything which happens near us, for instance economic crisis. We should predict what we have to do incase this situation appears. We must have plans for such kinds of unpredictable situations.

[9] : http://pordata.pt/en/Europe/Private+households+total+and+by+type+of+household+composition-1614

- **Technological**- Perhaps what civilization needs is a NOT-SO-FAST button. Proponents of technological determinism make a strong case for letting self-accelerating technologies follow their own life cycle. Besides, it isn't so easy for a free society to put the brakes on technology. Even if one country decided to forgo the next technological revolution, another country would gladly take it up. Constant technological revolution makes planning difficult, and a society that stops planning for the future is likely to become a brittle society. With so many powerful forces in play, technology could hyper accelerate to the stars with stunning rapidity, or it could stall completely. It is very important to improve products all the time. Technology and economy require it, to do progress as quickly as we can do.
- **Political**-The political environment includes all laws, government agencies, and lobbying groups that influence or restrict individuals or organizations in the society. In our opinion we shouldn’t have any problems with this environment, because we don’t have direct impact on society by introducing our product on the market.
- **Cultural**-The cultural environment includes institutions and other forces that affect the basic values, behaviors, and preferences of the society-all of which have an effect on consumer marketing decisions. When we would like to enter on the market in Portugal and Europe we have to know what are the main reasons for customers who are going to buy products. It is very important to recognize those reasons to see if costumers will be interested in our product or not.

1.3 SWOT ANALYSIS

In order to investigate the outlet, we should take into account not only the needs of customers, but above all competition. In the analysis we can consider the following features:

- brand
- price
- quality
- location
- life-cycle

SWOT Analysis Scale:

1-very small

2-small

3-medium

4-high

5-very high

Table 4 systematizes our SWOT analysis.

Table 4 SWOT Analysis

Strenghts +37	Weaknesses -24
-possibility to expand our assortment +5 -simultaneous entrance into different markets +3 -focusing on the development +4 -ability to be updated +5 -high quality of our products +5 -advertising +4 -website +5 -determination and obstinacy in setting up goals and achieving success +5	-no significant market = unknown brand -5 -high costs in case of creating a new brand in the outlet -5 -weak position in the market -4 -no experience in creating new products -5 -not really know what the market is and wants -5
Opportunities +15	Threats -17
-acceptance by customers of our new product +2 -quick position increase in the outlet +5 -entrance to new markets +4 -appearance of new groups of customers +4	-decline in prices of our competitors -5 -an opportunity of appearing new competitors -5 -increasing prices of raw materials -3 -an increase in general level of people's salary -4

$\Delta w=37+(-24)=13$

$\Delta z=15+(-17)=-3$

$\Sigma k=13+(-3)>0$

The SWOT analysis has shown that our product has a lot of strengths, more than weaknesses. Our strengths give us a chance to be important in the market, to be a good competitor for other products. If we are going to highlight weaknesses, it appears to be only the fact that our product will be new in the market.

3.3. OBJETIVES & ISSUES

OBJECTIVES:

1. Generate over 20,000€ in sales by the end of year 1.
2. Increase sales by 100% by the end of year 2.
3. Land 4 custom table development projects within 12 months.
4. Spread our product to Europe within 3 years.

ISSUES:

1. Product goals

- Operating goals

- To introduce an online sales - to find the best and the cheapest but with good qualities raw materials.

- Tactical goals (until one year)

- To improve the quality - to improve a wider range of product - to achieve steady growth of 10-20 % in sales during the three months through promotional activities and enrich range of new assortment - to reduce the cost of exporting waste segregation.

- Strategic goals (a few years)

- To increase spending on promotion - to gain a permanent group of customers - to improve current products - to expand our activities for foreign markets.

2. Customer Profile

Our product is targeted at 20 to 35 year-old people, especially young adults who would like to change their rooms. We would like to get clients, whose national average salary allows them to buy our product. They have a wide range of disposable income. Some young adults live at home, others may be college students or those who have joined the workforce in the last 10 years.

We think that our product could interest teenagers, because they always want something which is for older people. We know that they don't have money to get products, so their parents will do it. Their age could be around 30-35 years. The main characteristic of our shoppers will be crazy and modern people, who are able to change their environment using only one gadget. This product is for people who appreciate modern lifestyle and originality for an affordable price.

3. Market segmentation

Product positioning is closely related to market segment focus. The name 'positioning' is derived from the fact that its goal is to create a full picture of the product in the mind of the customer. We should carry out exposing the specific features of the product or brand, such as safety, convenience, price. So that the client will see our product in a certain way. If we want the client to choose our product, the customer must see in our product exactly what he is looking for, sometimes even without knowing it. We should understand needs the segment´s and expectations, and then position in such a way that the product can be associated to customers in the market with what they are looking for. The same product can be positioned in many different ways.

Common framework for product positioning is taken from a series of questions.

Therefore, we can position our product using a positioning statement that answers to these important questions:

1. For whom is the product designed? – The product is designed for young adults at the age of 20-35.
2. What kind of product is it? – It is a furniture, it is an interactive sound table.
3. What is the single most important benefit it offers? – This furniture object offers a kind of entertainment.

4. What is its most important competitor? – It doesn´t have direct competitors but other furniture companies may compete with our proposal. In Europe there is no company producing product the kind of we are proposing to produce.
5. How is your product different from that competitor? - Our product offers a unique value, which is sound coming out from table.

Currently, in the whole world there are few companies which have got similar products, so the competition is not so huge. We have a possibility to build a strong brand, to become the market leader. The creation of a strong brand allows us to increase our sales and thereby increase profits; moreover consumers get a guarantee of quality.

Our brand will be called: MATI (Music And Technology Item)

Slogan: Touch the Sound

Firstly, in this case our product will be available only in Portugal in furniture shops (we would like to sign contracts with furniture shops to place our product there), then when our product is known in the market, we will sell it via internet. So, in the future we would like to expand sales into other countries. We are thinking of Europe, starting with one European country at a time. We would like to spread our product in Europe within 3 years. Nowadays, everything is launched all over the world almost simultaneously.

1. Demographic segmentation:

- Age: between 20-35 year-old people
- Gender: Male/Female
- Income: Middle income level

2. Psychographic segmentation – Lifestyle:

People who can trust the newest “company” (team) that invented this new, fun and entertaining product.

3. Behavioral segmentation – Benefit:

The customers can improve their room appearance. They can have modern, innovating flat using our product.

3.4. MARKETING STRATEGY

3.4.1. Strategy

Our strategy focuses on developing an initial set of tables containing table attributes (colour, size, features) that can be combined to create new tables. Upon launching the first set of tables, we will stay in regular contact with our customers via numerous online methods, including social media and email marketing. After creating these tables, we will be able to market fast-turnaround selling tables to customers who would like their own innovative table. 20-35 year-old people like to share notes with other people via internet. On our web site, we will create a forum where they can post and respond to comments freely as well as offer suggestions for new clients. Forums will require registration and users who post more frequently will be rewarded with a special tag, a gold star, next to their avatar to show other users that they are a “super contributor” to the forums. It will tell people that they are appreciated.

3.4.2. Marketing mix

The marketing mix is a business tool used in marketing products. The marketing mix is often crucial when determining a product or brand's unique selling point.

The 'four Ps' consist of the following:

1. PRODUCT

The ‘product’ is concerned with the function and features offered by a good. “MATI” will be selling a lifestyle product, it will be an interactive sound table. Our brand in the market is not as strong as others, because it is a new one. The contemporary furniture industry is highly competitive and fast-moving. Fashion products tend to have a short life cycle. This means the time between the launch of a product and the point at which that product is 'mature' is very quick. Competition amongst fashion retailers forces businesses to refresh their ranges a number of times in a year. This topping- up modifies the product as it reaches the maturity stage. The boost of a new product or style then extends the life of the range, as shown on graph 4.

Graph 4 Life-cycle of a product[10]

Products need refreshing to avoid the dip in sales during the Saturation stage of the life cycle which could result in an early decline. The additions and changes help sales rise again, earning extra sales revenue and profit as well as maintaining the Ben Sherman brand in the market.

[10] http://businesscasestudies.co.uk

2. PRICE

Of all the aspects of the marketing mix, price is the one which creates sales revenue - all the others are only costs. The price of an item is clearly an important determinant of the value of sales made. In theory, price is really determined by the discovery of what customers perceive is the value of the item on sale. Researching consumers' opinions about pricing is important as it indicates how they value what they are looking for as well as what they want to pay. We can't define the price of our product, but if we must say a price, we should consider the materials. For one table we are going to spend something about 400€, but we have to add that this is only one product. When the production is higher it will be cheaper, because costs decompose for everything (production, staff, place, materials, etc..). Suppliers will not be retailers but merchants. Our product pricing strategy includes the flexibility to lower the prices if the consumer´s response dictates such an action. Firstly, we will choose psychological point pricing, it means that the marketing practice is based on the theory that certain prices have a psychological impact, for instance 99,99€ is more attractive than 100,00€. After this kind of price setting, we can change our price strategy. Then our market orientated pricing covers the approach: - market skimming where a new product has premium pricing to give high revenues whilst the product is unique in the market.

3. PROMOTION

Promotion is the business of communicating with customers. It will provide information that will assist them in making a decision to purchase a product. The cost associated with promotion or advertising goods often represents a sizeable proportion of the overall cost of producing an item. However, successful promotion increases sales so that advertising and other costs are spread over a larger output. The purpose of promotion is to obtain and retain customers. We are going to use both above-the-line and below-the-line promotion to help inform customers about products.

'Above-the-line' will allow us to use independent media to reach a wide audience easily, but over which our team may have limited control, for example, magazine advertising. This reaches a mass audience but can be hard to measure its impact. Promotion 'below-the-line' can give us use media over which the business has control, for example, direct mailing. This type of promotion can be more cost-effective and give more measurable response rates.

Our communication will also include:

-website

-advertising via media

-leaflet

-direct mail - for example, catalogues, newsletters you may receive by post or email

-public relations - perhaps through press conferences or by participating in events

-sponsorship (when we gain huge income)

-branding- you can see MATI brand in the layout and decoration of stores, where we are going to place our table

4. PLACE

Place is not always a physical building such as a retail outlet or shop, but includes any means by which the product is made available to the customer. A business has to balance getting enough of its products to its target customers against the problems or costs of distributing them. Although figures vary widely from product to product, roughly a fifth of the cost of a product goes on getting it to the customer. 'Place' is concerned with various methods of transporting and storing goods, and then making them available for the customer. Getting the right product to the right place at the right time involves the distribution system.

The choice of the distribution method will depend on a variety of circumstances. It will be more convenient for us to sell our product to retailers.

We have chosen indirect distribution:

Manufacturer –> Retailer –>Consumer

Depending on the type of product being distributed we should choose one type. In our situation it will be a selective distribution. We selected it because this kind of distribution is common with products. Where customers are willing to shop around and where manufacturers want a large geographical spread.

When our brand gains opportunity to be a “known brand” we can change our strategy. For a premium brand, making the products too easily available might reduce the perceived value of the brand. This illustrates the need to select carefully how the marketing mix is put together to match the product to the needs of the target market.

3.5. ACTION PROGRAMS

”An interactive sound table” is a new product in the market, because there isn´t furniture of this kind being sold in the market. Currently, there are lots of products which are quite similar, but they don’t have sound, so we’ve got something innovative. Our product should signalize that it is trying to enter the market and show advantages. Throughout the promotional advertising campaign our product would like to reach 20 to 35 year-old people, especially young people, who would like to change their rooms. Promotional advertising campaign has a big influence on the product position in the market and is very important in the product strategy. It has key-influence on product sales. The success of the implemented promotional advertising campaign is not only determined by its professionalism and innovation, but also by its competitive capability. In order to create an appropriate campaign, with an

appropriate meaning and purpose, we must first analyze the market and customers' needs.

Our goal is to create the perfect strategy promotion for "an interactive sound table". To create a successful campaign we should first do a market analysis, an analysis of the target group, an analysis of the effects of the campaign. We should also plan a pre-design and execution of advertising media and then develop an advertising concept.

Our communication will also include:

-website

-advertising via media

-leaflet

-direct mail - for example, catalogues, newsletters you may receive by post or email

-sales promotions - such as discounts

-public relations - perhaps through press conferences or by participating in events

-sponsorship (when we gain huge income)

-branding- you can see MATI brand in the layout and decoration of stores, where we are going to place our table

We assumed that we would like to generate over 20.000€ in sales by the end of year 1, and land four custom table development projects within this year. If we would like to achieve it, we should break this year into four sections. In the first section we should establish our website, make a leaflet and of course it must become one of four custom table development project. In the second section we can provide direct email,

and make our product more popular via branding, here the second project of the table.

In the third and fourth sections we should improve our website and leaflet. Of course we can't forget about PR (which will be positioning our product in well-known places like shopping-malls). Here two other projects of improved table will appear.

In the second year, we assume that we want to increase sales by 100% by the end of year 2. We will achieve it through improving our website, leaflet, starting advertising via mass media (it is more expensive), but if we generate over 20.000€ in sales by the end of year 1, we will have money to do it.

In the end of the third year we can start considering sponsorship, it is very good for promoting our product, a lot of people come to the most varied events. We hope that in the end of this year our product will be all around Europe, in every country. To achieve it we will advertise our product via mass media in Europe.

3.6. BUDGET

If we are going to think about budget, we should know that in the first year our "company" will not give any profits. After one year or maybe one and a half year it could gives us income.

MARKETING EXPENSE BUDGET:

We do not expect an increase in marketing staff requirements during year 1 because our team can actually do a lot of these activities. Once we have put the marketing plan processes into place, the marketing activities upkeep becomes easier and can be handled by us. In the table 5 it is presented a breakdown of marketing expenses by month for year 1.

Table 5 Marketing Expense Budget

MARKETING EXPENSE BUDGET													
	january	**february**	**march**	**april**	**may**	**june**	**July**	**august**	**september**	**october**	**november**	**december**	**FINAL COST**
Our website	500€	10€	10€	10€	10€	10€	10€	10€	10€	10€	10€	10€	610€
Leaflet	50€	50€	50€	50€	50€	50€	50€	50€	50€	50€	50€	50€	600€
Direct email	50€	50€	50€	50€	50€	50€	50€	50€	50€	50€	50€	50€	600€
PR (transportation)	100€	100€	100€	100€	100€	100€	100€	100€	100€	100€	100€	100€	1200€
Branding	80€	80€	80€	80€	80€	80€	80€	80€	80€	80€	80€	80€	960€
FINAL SUM													**3970€**

We anticipate the second and third years marketing expenses to increase, again mostly for covering the cost of additional staff to help facilitate the additional requirements for marketing activities (Table 6).

Table 6 Marketing Expense Budget (second % third year)

MARKETING EXPENSE BUDGET (second & third year)													
	january	**february**	**march**	**april**	**may**	**june**	**July**	**august**	**september**	**october**	**november**	**december**	**FINAL COST**
Our website	20€ x 2 =40€	20€ x 2 =40€	20€ x 2 =40€	20€ x 2 =40€	20€ x 2 =40€	20€ x 2 =40€	20€ x 2 =40€	20€ x 2 =40€	20€ x 2 =40€	20€ x 2 =40€	20€ x 2 =40€	20€ x 2 =40€	480€
Leaflet	100€ x2 = 200€	100€ x2 = 200€	100€ x2 = 200€	100€ x2 = 200€	100€ x2 = 200€	100€ x2 = 200€	100€ x2 = 200€	100€ x2 = 200€	100€ x2 = 200€	100€ x2 = 200€	100€ x2 = 200€	100€ x2 = 200€	2400€
Direct email	50€ x2 = 100€	50€ x2 = 100€	50€ x2 = 100€	50€ x2 = 100€	50€ x2 = 100€	50€ x2 = 100€	50€ x2 = 100€	50€ x2 = 100€	50€ x2 = 100€	50€ x2 = 100€	50€ x2 = 100€	50€ x2 = 100€	1200€
PR	400€ x2 = 800€	400€ x2 = 800€	400€ x2 = 800€	400€ x2 = 800€	400€ x2 = 800€	400€ x2 = 800€	400€ x2 = 800€	400€ x2 = 800€	400€ x2 = 800€	400€ x2 = 800€	400€ x2 = 800€	400€ x2 = 800€	9600€
Branding	200€ x2 = 400€	200€ x2 = 400€	200€ x2 = 400€	200€ x2 = 400€	200€ x2 = 400€	200€ x2 = 400€	200€ x2 = 400€	200€ x2 = 400€	200€ x2 = 400€	200€ x2 = 400€	200€ x2 = 400€	200€ x2 = 400€	4800€
Advertising via media	1000€ x2= 2000€	1000€ x2= 2000€	1000€ x2= 2000€	1000€ x2= 2000€	1000€ x2= 2000€	1000€ x2= 2000€	1000€ x2= 2000€	1000€ x2= 2000€	1000€ x2= 2000€	1000€ x2= 2000€	1000€ x2= 2000€	1000€ x2= 2000€	24000€
Sponsorship	400€ x2 = 800€	400€ x2 = 800€	400€ x2 = 800€	400€ x2 = 800€	400€ x2 = 800€	400€ x2 = 800€	400€ x2 = 800€	400€ x2 = 800€	400€ x2 = 800€	400€ x2 = 800€	400€ x2 = 800€	400€ x2 = 800€	9600€
FINAL SUM													**52080 €**

3.7. CONTROLS

The control process involves carefully collecting information about a system, process, person, or group of people in order to make necessary decisions about each of them. Simply put, product control is the process of assigning, evaluating, and regulating resources on an ongoing basis to accomplish a product's goals. To successfully control a product, we need not only to know what the performance standards are, but also figure out how to share that information with co-workers.

A good control system should:

- Be flexible so managers can respond as needed
- Provide accurate information about the organization
- Provide information in a timely manner

The control system consists of four steps:

1. Establish standards to measure performance. Within a product's overall strategic plan, we define goals for product in specific, operational terms that include standards of performance to compare with all activities.

2. Measure actual performance. We should prepare formal reports of performance measurements regularly to control our actions. These measurements should be related to the standards set in the first step of the control process. For example, if sales growth is a target, we should have a means of gathering and reporting sales data.

3. Compare performance with the standards. This step compares actual activities to performance standards. When we read computer reports or walk through their plants, they identify whether actual performance meets, exceeds, or falls short of standards. Typically, performance reports simplify such comparison by placing the performance standards for the reporting period alongside the actual performance for the same

period and by computing the variance—that is, the difference between each actual amount and the associated standard.

4. Take corrective actions. When performance deviates from standards, we must determine what changes, if any, are necessary and how to apply them. In the productivity and quality-centered environment, workers are often empowered to evaluate their own work. After the evaluator determines the cause or causes of deviation, he or she can take the fourth step—corrective action.

Control system is very important. We should control every action all the time, because when we don't control, for instance we can lose some income.

In our situation we should control:

- Changes in micro & macro environment: the most important for us are in technological point, because we should improve our product all the time. Technology requires it, to do progress as quickly as we can do.
- Competition: what they have got new, if we should change something in our product or not, how we can improve it
- Our action program: if it is going according to what we planned, or not. If it is not compliant with our plan we should change our action program. To watch competitors advertising.

3.8. CONCLUSIONS

This marketing plan illustrates our market segments and the strategies we are employing to get clients and create a solid revenue stream. First of all we analyzed the market environment, which consists of two sections, micro and macro environments. The most important aspect in the microenvironment is that there are few companies in the world who are selling products with similar properties as ours. So in our opinion competition is not so huge. From the perspective it is positive that

the product we are going to produce is much more innovative and modern than others already in the market.

Our advantage is that our table gives sound. We haven't found something like that, it is a new option for tables. Our product is targeted at 20 to 35 year-old people, especially young adults with medium to high income. The main characteristic of our shoppers will be crazy and modern people, who are able to change their environment using only one gadget. We think that our product could interest teenagers as well, because they always want something which is for older people. We know that they don't have money to get products, so their parents will do it. Our product is for people who appreciate modern lifestyle and originality for an affordable price.

The contemporary furniture industry is highly competitive and fast-moving. Fashion products tend to have a short life cycle. This means the time between the launch of a product and the point at which that product is 'mature' is very quick. Competition amongst fashion retailers forces businesses to refresh their ranges a number of times in a year. It is very important to improve products all the time, to make some improvements. Technology requires it, to do progress as quickly as possible.

Firstly, in this case our product will be available only in Portugal in furniture shops (we would like to sign contracts with furniture shops to place our product there), then when our product is more "famous" we will sell it via internet. So in the future we would like to expand sales to other countries all around Europe within 3 years.

Getting the right product to the right place at the right time involves the distribution system. The choice of a distribution method will depend on a variety of circumstances. It will be more convenient for us to sell our product to retailers. We have chosen indirect distribution: Manufacturer –> Retailer –>Consumer. Depending on the type of product being distributed we should choose one type. In our case it will be a selective distribution, because this kind of distribution is common with products, where customers are willing to shop around and where manufacturers want a large geographical spread.

We have a possibility to build a strong brand, to become the market leader. The creation of a strong brand allows us to increase our sales and thereby increase profits; moreover consumers get a guarantee of quality.

Price is the only aspect which creates sales revenue - all the others, like promotion, are only costs. For one table we are going to spend something about 400€, but we have to add that this is only one product. Enlarging the production, the costs will be lower, because these decompose for everything (production, staff, place, materials, etc..).

Our product pricing strategy includes the flexibility to lower the prices if the consumer´s response dictates such an action. Firstly, we will choose psychological point pricing, it means that marketing practice is based on the theory that certain prices have a psychological impact, for instance 99,99€ is more attractive than 100,00€. After this kind of setting price, we can change our price strategy. Then our market orientated pricing covers the approach: market skimming where a new product has premium pricing to give high revenues whilst the product is unique in the market. We have got several ideas to promote our product, for instance : our website, advertising via media, leaflet, direct mail, public relations (perhaps through press conferences or by participating in events), sponsorship (when we gain huge income), branding-(you can see MATI brand in the layout and decoration of stores, where we are going to place our table).

We assume that we would like to generate over 20.000€ in sales by the end of year 1, and land four custom table development projects within this year. If we want to achieve it, we should break this year into four sections. In the first section we should establish our website, make a leaflet and of course it must become one of four custom table development project. In the second section we can provide direct email, and make our product more popular via branding, here the second project must come into being. In the third and fourth sections we should improve our website and leaflet. Of course we can't forget the PR (which will be positioning our product in well-known

places like shopping-malls). Here two other projects of improved table will appear. In the second year, we assume that we want to increase sales by 100% by the end of the year. We will achieve it through improving our website, leaflet, starting advertising via mass media. In the end of the third year we can start sponsorship, it is very good for promotions our product as a lot of people are coming for events. We hope that in the end of this year our product will be commercialized all over Europe. To achieve this we will advertise our product via mass media in Europe.

The most important thing is to control everything, what we would like to gain. For instance, in our situation we should control changes in micro & macro environment, the most important for us in the technological aspects, because we should improve our product all the time. Technology requires it, to do progress as quickly as we can do and of course competition- what they've got new, if we should change something in our product or not, how we can improve it. The other thing to control is our action program, if it is going according to what we planned, or not. If it is not, we should change our action program. To watch competitors advertising.

4. ECO-EFFICIENCY MEASURES FOR SUSTAINABILITY

4.1. THE LIFE-CYCLE OF AN INTERACTIVE SOUND TABLE

Eco-efficiency generates more value through technology and process changes whilst reducing resource use and environmental impact throughout the product's life. Eco-efficiency applies to all business aspects, from purchasing and production to marketing and distribution. Eco-efficiency calls for business to achieve more value from lower inputs of materials and energy and with reduced emissions.

The main aspects of eco-efficiency are:

- Reduction of energy, water and virgin material use
- Reduction of waste and pollution levels
- Extension of function and therefore product life
- Incorporation of life cycle principles
- Consideration of the usefulness and recyclability of products at the end of their useful life
- Increased service intensity

The question is: How can we apply those aspects to our product? It is impossible to create an ideal product, so we will try to make our product as much eco-efficient as possible.

THE LIFE CYCLE OF OUR PRODUCT "AN INTERACTIVE SOUND TABLE"

1. Extraction of raw materials

The term 'sustainable product' can be subjective and include a wide variety of economic, social and environmental considerations while protecting public health, welfare, and environment over their full commercial cycle, from the extraction of raw materials to final disposal. One broad definition of a 'sustainable product' is an item or service that minimizes its impact on the environment at each phase of its life cycle. Unfortunately, most products do not exist on a simple continuum from 'green' to 'brown' and so are not easy to compare. Usually their environmental impacts vary at different stages of their life cycle.

Figure 6 represents the life-cycle of all products in the world.

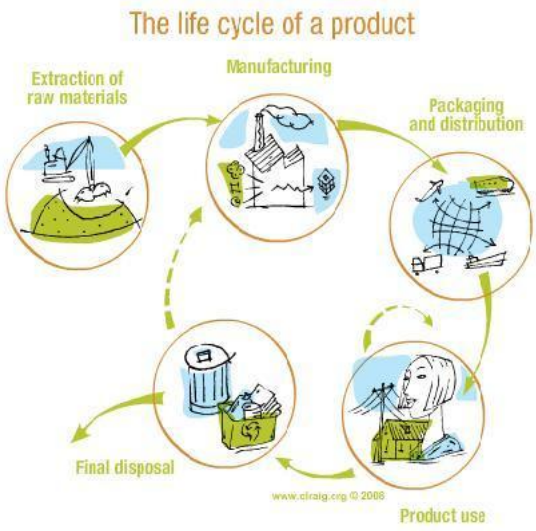


Figure 6 The life cycle of a product[11]

[11] http://www.treehugger.com/sustainable-product-design/rona-including-product-life-cycle-information-in-stores.html

For instance:

- A product may be easy to recycle but be resource-intensive to manufacture (e.g. electronic equipment) or is used for a relatively short time (e.g. paper or plastic bags).
- A product may last a long time but may be toxic or difficult to recycle (e.g. treated timber).

Choosing sustainable products is about trying to find a balance between different environmental characteristics over the life of the product. This report describes the sustainability work carried out to our product and the respective results. Our project is an interactive sound table; to build it we are using different materials.

Our table consists of:

1. WOOD

We are going to buy a “ready table” from IKEA. IKEA doesn’t accept wood from illegal stretch or wood obtained from virgin forests. They gain wood from forests which have certificate of responsible management from Forest Stewardship Council (FSC). Recycling wood decreases landfill operator and haulage costs while freeing up landfill space thereby extending landfill life. Recycled wood in the form of wood chips can be used as an alternative energy source for generating electricity since wood burns cleaner than coal. Recycling wood is good for the economy and creates additional businesses by creating innovative uses for recyclable wood products. One positive aspect about using wood is that wood is recyclable material so it grows back and can be used several times. Therefore, we believe our choice is right.

2. GLASS

We are going to use this material to cover our table. The main advantage of glass is that it can be processed an unlimited number of times. Recycling one ton of glass saves: 603 kg of sand, 196 kg soda ash, 196 kg limestone and 68.5 kg of feldspar. This way we can limit landscape degradation.

Also producing from recyclable glass we can save:

- energy consumption by 25-32%
- water consumption by 50%
- air pollution by 14-20%
- industrial waste by 97%

In our opinion the choice to use glass is good, because glass is 100% recyclable and can be used again and again.

3. LED

LED shines, … & shines, .. & shines …

LED technology is a revolution in the lighting industry, because LED not only saves energy, but also LED shines much longer.

Features of LEDs:

- Lifetime up to 25,000 hours (25 years)
- Consume 80% less energy than traditional bulbs
- Led gives good and steady light with a similar colour as traditional light bulb
- Led gives light immediately, while traditional light bulbs have to heat up

- Led doesn't include mercury, but we found that they have got lead, arsenic, copper and nickel, which are also very dangerous substances for people. Each of these compounds has a negative impact on health. Lead and arsenic contribute to develop cancer, kidney and nervous system disease, nickel and copper- allergies and kidney disease. Harmful chemicals are found in every art of the diode, which proves that the risk of exposure to them occurs both during production, use or recycling.
- We have chosen it because they give light immediately. LED are recyclable and they use 80% less energy than traditional bulbs. We should never throw away LED bulb with our household trash. Proper disposal of LED bulbs is helpful for environment and very simple to do. Such shops like IKEA have recycling bins set up in front of the store into which you may drop used bulbs.

4. ELECTRONIC STUFF

E-waste is a system whereby electronic items can be properly discarded and recycled without posing a threat to the environment. When you e-recycle you are helping to protect the environment as well as create new jobs all around the world.

The electronic items we are going to use are made of some valuable metals, including copper and gold, which can be sold and then reusable in alternative capacities. From an environmental standpoint, the fact that these items are reused is far more important than any monetary benefits of recovering these valuable materials. However, e-waste recyclers are also recycling and reusing materials that aren't nearly as valuable. In general, as much as 99 percent of all materials from electronics are reused in a different capacity or sold. The vast majority of these materials are used for new electronic items because some of the material, such as the plastic, is already the right grade for electronic devices. There are a lot of methods to recycle electronics. Such products may be easy to recycle but they are resource-intensive to be manufactured.

2. Manufacturing

Pollution can be more effectively handled by reducing upstream sources of pollutants than by using wide downstream treatment processes. Equivalently, “Do your best, and then treat the rest.”

Many aspects of manufacturing processes have important implications for the condition of the natural environment. Nevertheless, many products can be manufactured by using two or more alternative processes. Often, one of the process types involves the use of less vicious substances than others. That’s why we can say that there is usually a choice to make among several sources for the equipment, and one type may be more advisable from a pollution prevention standpoint than others. From the beginning of any manufacturing process, pollution prevention should be a fundamental objective. That objective should be pursued through process development, process design, engineering to construction, startup, and operation. It should also be a continuing objective of plant engineers and operators once the unit begins production. The best time to consider pollution prevention is when the process is first started.

Today, because of the waste materials and related emissions from the basic processes, it is very important to find in every manufacturing process solutions to treat wastes as close as possible to the source and to reuse as much material as possible. Our manufacturing will be interested in reducing the energy consumption in the factory, which we will open when we afford to produce our product. And for that manufacturing process designers should always consider energy conservation including, for example: saving energy by using more efficient equipment, reducing energy use through proper maintenance and sizing machines engines. Also, renewable energy sources such as the sun, wind, and water offer electricity for the cost of the generating equipment. We think that it will be a very good idea to use renewable energy in our future factory.

For instance, energy source such as the sun. In our opinion it is better to invest at the beginning and get the money back in few years. In case the equipment is old, worn, and subject to leaks, spills, and inefficient use of materials, it might be cost effective to replace it, based on the savings, in the cost of materials, cost of operation, and cost of handling and disposing of the wastes.

3. Packaging and distribution

Packaging and distribution are closely related to each other. We are considering to use sustainable packaging which provides a variety of distribution capabilities. Sustainable packaging must meet the functional and economic needs of the present without compromising the ability of future generations to meet their own needs, but also it will be a good solution to transport our product. Because when packing our product, we would like to have a small portable package with a simple shape to pack a lorry with as many products as we can transport from one place to another. Our product will be traveling all over Europe, so it is very important to have small packages. We also need to consider logistics, because when our product is sold in shops, we will be a wholesaler. So, for us it will be better, cheaper and more environmentally-friendly to use lorry and transport packages at a time, not to do it few times via this type of transport.

4. Product use

Reduction of energy First of all we did the estimation of energy consumption of our product (table 7).

We started to calculate everything we are going to use:

1. Maximum power consumption is 59W.
2. One month has 30 days x 24 hours = 720 hours
3. 0,059KW x 720h= 42,48 kWh
4. What about price? We are from different countries, so we made a research on the prices practiced in each country. This is presented in table 7.

Table 7 Price calculations for power consumption

Country:	Estonia	Lithuania	Poland	Portugal	Spain
Price- 1kWh/€	0,12	0,13	0,09	0,12	0,15
Calculations:	42,48 x 0,12	42,48 x 0,13	42,48 x 0,09	42,48 x 0,12	42,48 x 0,15
Final price:	5,09 €	5,52 €	3,82 €	5,09 €	6, 37 €

As we can see in table 7 energy costs in Poland will be the lowest, in Spain the highest. The maximum power consumption of our product is 59 W, it means that costs during one month will be very low, because of the LED. We have broken our table into 9 sections, using 36 LED, 4 LED in each section. All sections are not going to work together at the same time. LED not only saves a lot of energy, but they shine much longer. They are consuming 80% less energy than traditional bulbs. Another reason for LED to be a good choice is that they light up immediately, which is very important for our product. We didn't want the light to heat up.

Results of our calculations give us an opportunity to say that our table will be saving a lot of energy because of the LED. When using our table all day and all night (24 hours per day) we will pay something about 5,35 € per month (average of countries). So during the whole year we will pay 5,35 € x 12 = 64,2 €. We think that this amount is not that high, but we should look that we measured it for 24 hours working .

We don't think that somebody will have it all day and all night switched on, so costs will be probably lower.

5. Final Disposal

In case of our product, firstly we have to take production materials into consideration. Reuse of materials involves either the voluntary continued use of a product for a purpose for which it may not have been originally intended, or the extended use of a product. We can divide our product into four sections: wood, glass, leds and electrical items. In materials reuse the product does not return to the industrial sector, but remains within the public or consumer sector. When our product will be useless we can do several things. For instance, we can separate our product into four parts and each of them should be taken to the right place. For example, we can use electrical things one more time. Reuse of materials is a non-polluting, eco-friendly and economically smart action. Recycling is beneficial in two ways: it reduces the inputs (energy and raw materials) to a production system and reduces the amount of waste produced for disposal. So, if we have the choice to recycle something, we should do it.

4.2. CONCLUSIONS

Eco-efficiency applies to all business aspects, from purchasing and production to marketing and distribution. Eco-efficiency calls for business to achieve more value from lower inputs of materials and energy with reduced emissions.

We have tried to make our product as much environmental-friendly as possible. We have started from the product life-cycle. Firstly, we have got materials, which are very important. We have chosen several materials like wood, glass, electronic things and LEDs. Our manufacturing will be interested in reducing the use of energy. We think that it will be a very good idea to use renewable energy in our future factory. For instance, energy source such as the sun. In our opinion it is better to invest at the begging and then to get back money in few years. In case where equipment is old, worn, and subject to leaks, spills, and inefficient use of materials, it might be cost effective to replace it, based on the savings in cost of materials, cost of operation, and cost of handling and disposing of the wastes. Packaging and distribution are closely related to each other. We are thinking about sustainable packaging which gives variety of capabilities of distribution, because when we are going to pack our product, we would like to have a small package which can be “portable” and which can have simple shape to pack a lorry with a lot of products as much as we can transport from one place to another. Our product will be traveling all over Europe, so it is very important to have small packages. We have to think about logistic, because when we are going to sell our products in shops, we will be a wholesaler. So for us, it will be better, cheaper and more environmentally-friendly to use lorry and transport packages in one time, not to do it few times via this type of transport. Product use is for us the most important thing, because we can feel like we are customers.

Each of clients would like to use product as long as he/she can, and of course when it consumes some energy it must be less expensive. We have tried to do a small experiment. We calculate how much power consumption (maximum) our product is going to consume. The maximum power consumption of our product is 59 W, it means that costs during one month will be very low, because of LEDs. We have broken our table into 9 sections, we are using 36 LEDs, 4 LEDs for one section. All sections are not going to work together in the same time. LEDs not only saves a lot of energy, but they shine much longer. They are consuming 80% less energy than traditional bulbs. Another reason that choosing LEDs was good choice is that they light up immediately, which is very important for our product. We didn't want the light which has to heat up. Results of our calculations give us an opportunity to say that our table will be saving a lot of energy because of LEDs. When we will be using our table all day and all night (24 hours per day) we will pay something about 5,35 € per month (average of countries). So during whole year we will pay 5,35 € x 12 = 64,2 €. We think that this amount is not so huge, but we should look that we measured it for 24 hours working… We don't think so that somebody will have it all day and all night switch on, so costs will be probably lower. In case of final disposal it is connected with materials which we are using to produce our product. We have broken our product into four sections: wood, glass, LEDs and electrical things. In materials reuse the product does not return to the industrial sector, but remains within the public or consumer sector. When our product will be useless we can do several things. For instance we can separate our product into four parts and each of them we should take it to right place, for example we can use electrical things one more time. Reuse of materials is a non-polluting, eco-friendly and economically smart thing.

In our opinion eco-efficiency includes producing more with less. It is extremely important to create production of economically valuable goods while reducing the ecological impacts of production, because everybody goes shopping every day.

5. BUILDING AND TESTING THE PROPOSED SOLUTION

First of all we performed some tests with LED – we needed to know how much intensive they could light. Then we made schemes and drawings for each of the electronic sections. After that we needed to make music with music writing programs. Then we created midi files which were put into the music instrument shield. Of course, we did arduino programming codes.

6.PROJECT DEVELOPMENT

In the project development part we describe the general parts of the project architecture, modules, schematics, functionalities, and the required tests.

6.1. ARCHITECTURE

This chapter describes the general parts of the project architecture.

Figure 7 presents the overall architecture of the interactive sound table. As we can see, the product consists of three parts: a controller, a sound block and nine light and IR blocks. The controller is connected to the sound block and to the light and IR blocks.

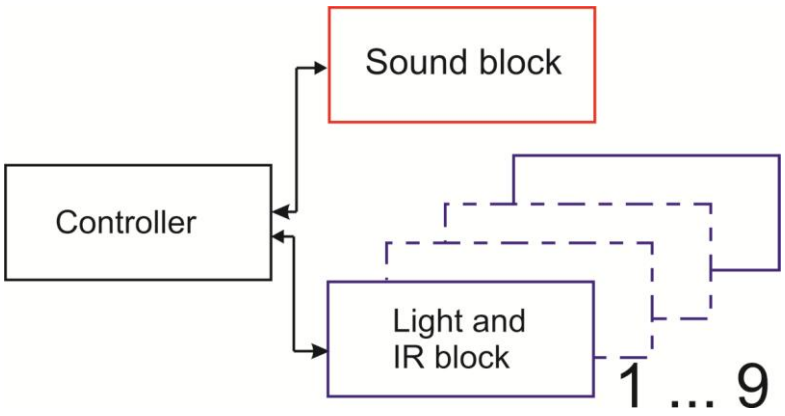


Figure 7 An interactive sound table architecture

6.2. MODULES

Our system is composed of three different main blocks. The main one is the controller, the second one is the sound block and the third one is composed of the nine light and IR blocks. Components of the sound block are the Music Instrument Shield and the Speaker. The Components of the light block are nine blocks of IR sensor and four LED.

Figure 8 presents the detailed architecture of the interactive sound table.

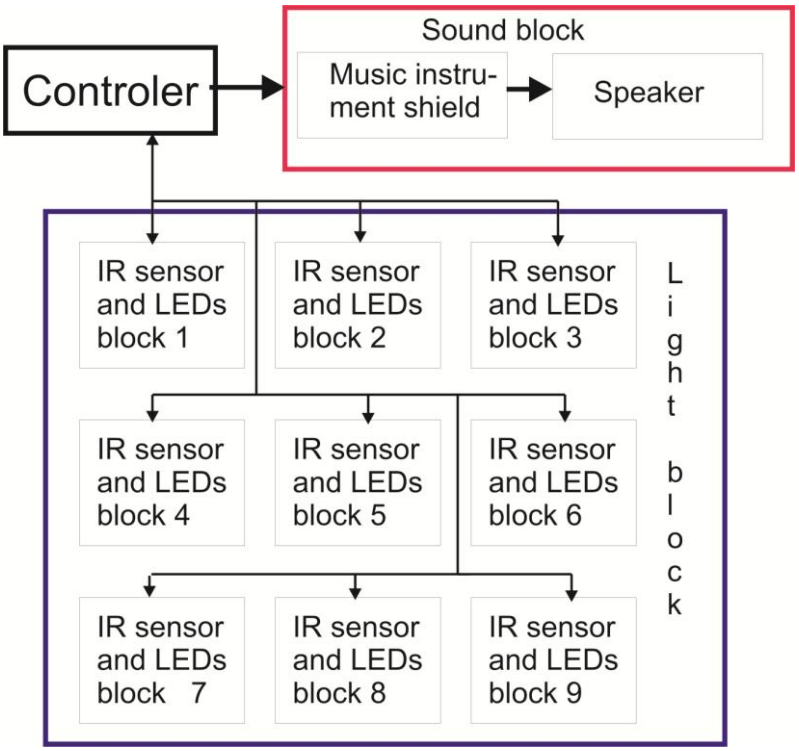


Figure 8 Detailed architecture of the interactive sound table

6.3. FUNCTIONALITIES

Figure 9 presents electronic schematic of our product.

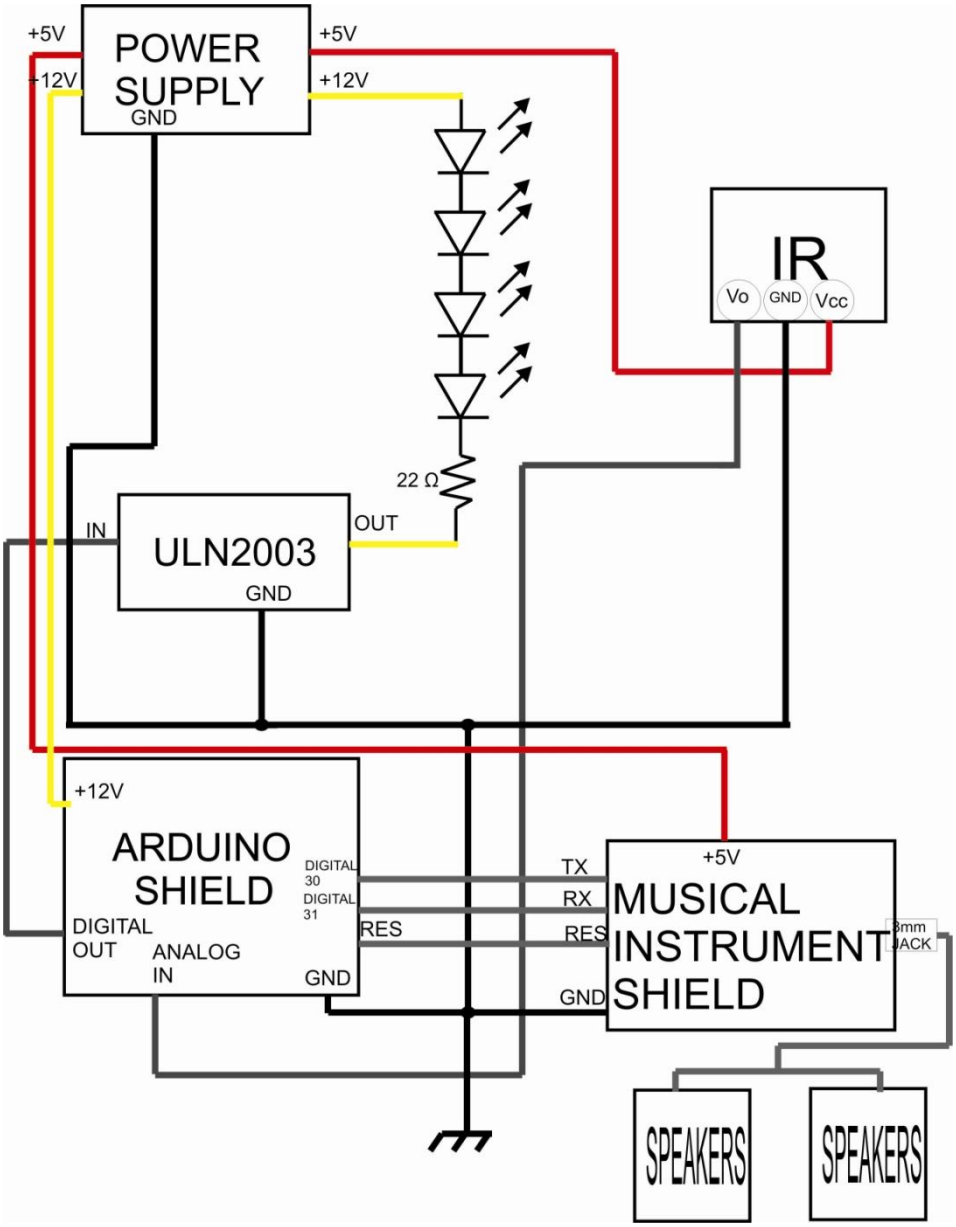


Figure 9 Schematic

The power supply provides 5 V to IR sensors, 12 V to the LED circuit, 5 V to Arduino shield and 5 V to Musical instrument shield.

We made nine sections of four LED and 1 IR sensor. Four LED are connected to the circuit with ULN2003 (high voltage and high current Darlington transistor array) for protection. Each ULN2003 input goes to Arduino shield‘s nine digital outputs and each Infrared sensor output goes to Arduino shield‘s nine Analog inputs. When IR sensor fix some movement LED start to shine. Arduino shield TX and RX pins are connected to Musical instrument shield‘s to two digital pins that in Software one can create "fake serial port" for sending the "notes" to the music shield. The speakers are connected to the musical instrument shield, so that notes are sent to Arduino and when we get a signal from the Infrared sensor we can hear sound through the speakers.

ARDUINO CODE

Figure 10 describes how logical functions communicate.

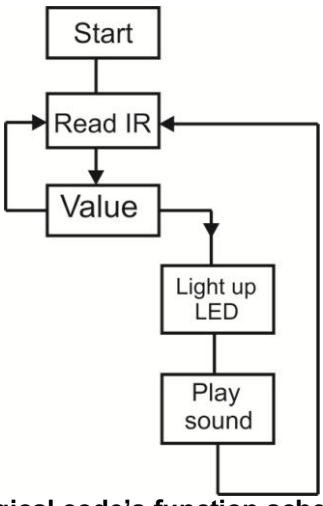


Figure 10 Logical code’s function schematics

Function “Light up LED”

IR sensor is connected to analog pin to LED pin. LED light depends of the value. If value is greater than 100 LED light turns on.

Below is an example of the code.

```
…
void read_sensor_and_change_led_light(int analogPin, int ledPin){


    int val_a0 = analogRead(analogPin);
    //Serial.println(val_a0);
    double val =0;
    if(val_a0>100){
    double val= val_a0-100;
      if(val<550){
        val=val/550 * 255;
        val= round(val);
      }
      else{
        val =255;
…
```

Function "Play sound"

At first we set an instrument and than give a task to play it in different notes if the value of the sensor (which is connected to analog pin) is greater than 100.

Below is an example of the code.

```
…
talkMIDI(0xC0, instrument, 0);
   int sensorValue = analogRead(number);
 if (sensorValue < 100) {goto ending;}
 Serial.println(sensorValue);
       delay(1);
      note=sensorValue/3;
…
```

6.4. TESTS

With our test we want to find IR sensors working distance. Figure 11 shows the graphics of the test.

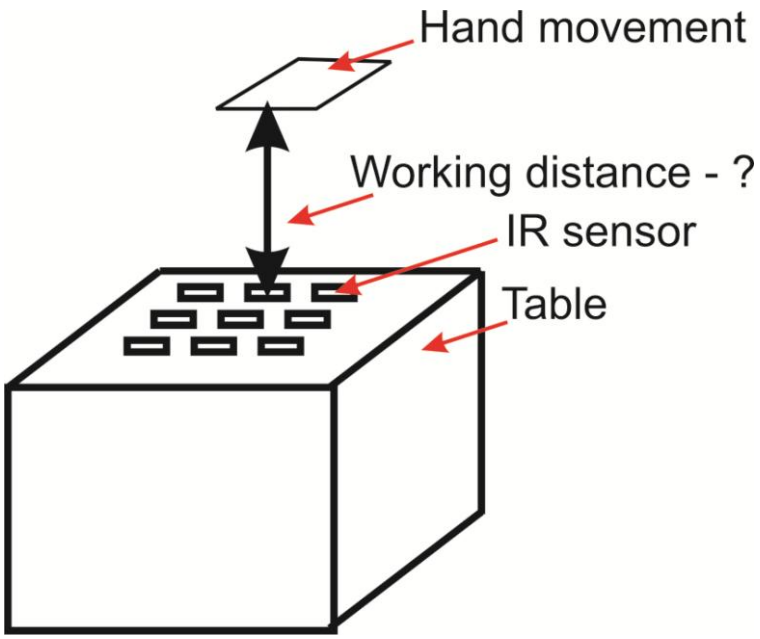


Figure 11 Test schematic

Expecting results: detecting distance from 10 cm to 80 cm

Results: detecting distance from 0 cm to 35 cm

7.CONCLUSIONS

7.1. DISCUSSION

First of all we had lots of ideas about what kind of project we would like to do. Finally, we chose “An interactive sound table”, which right now, in our opinion, was the best choice. We learnt much more making it than we expected to learn. During the project development we had some problems on how to make it, but we have always found some solutions. For instance, the hardest to accomplish was the electronic and programming parts, because none of us is from this study are. We made it!

We are very proud, because we gave to our costumer many options how to use the interactive sound table. That was one of the main tasks, therefore, we found good materials and an easy way of developing an electrical product connected to programming which allowed us to build it in a high quality. Finally, we have a product which is not only interesting, but also usable and entertaining.

In the future development there are lots of possibilities. In the following sections we make some suggestions.

7.2. FUTURE DEVEPLOMENTS

There is no doubt that the system we built is popular — lots of products are using it nowadays. But when this kind of system first appeared in the marketplace, it was not expected to be used solely for entertainment. Instead, they were expected to be widely adopted by business people on the go.

7. CONCLUSIONS

As this system continues to evolve, there will be many more new uses and technologies developed to make it even more useful. Let's look at the following trends that may affect the future development of our product:

1. Design

We have to always change our product, make some improvements. Design allows designers to add or remove features and content based on device resolution and orientation.

2. New feature-video

To develop our product we can add video to it. There will be not only sound and light, but the product will have an option to watch TV, movies, clips and other visual information.

3. Completely new product

We can use our system, as a totally new product. We can sell it not as a product which is a table, but as product which will be a system to sell.

4. New colors of LED/ tables

When we will change the colors of LED/table it will be a totally new product. We can change everything to one color, or we can put lots of different colors.

5. Put SD Card

To integrate Musical shield which would be with micro SD card which allow people to personalize it in the easy way. You can put your own music in this and listen whatever you want.

6. New product for kids

It could be a product only for children, it will be like a toy for them to play with it and have fun. Variety of different music, for instance animals sounds.

7. Distance changes colour of LED

When you change value of distance it will change not only brightness and notes value, but LED color.

8. Remote controll system

When we will install remote control system clients could change the volume, the color of LED, music.

9. More LED in one table

We can put much more LED in one table and it could give better impression to see it and play with it.

10. Using batteries

It will give a possibility to make our product portable.

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