



I3E
South East Europe TCP

Best Practice Report

MikroElektronika

Document type : Best practice report
Document version : Final
Document Preparation Date : December 13th, 2010
Classification : Internal
Contact :
Project co-ordination : ISI – Industrial Systems Institute
Deliverable Responsible : UoK – University of Kragujevac

Good Practice Report

Rev.	Content	Resp. Partner	Date
0.1	Creation of document	UoK	13.12.2010

Everybody please state revision index and short description of what has been done + partners involved and date.

Final approval	Name	Partner
Reviewer		

Abbreviations:

GP – Good Practice

R&D – Research and Development

SEE – South East Europe

SMD – Surface Mounting Device

1. Best Practice Title

MikroElektronika 
 SOFTWARE AND HARDWARE SOLUTIONS FOR EMBEDDED WORLD ...making it simple

2. Location of Best Practice

Country, region, town

Headquarters: Serbia, Belgrade; Production facilities: Serbia, Lajkovac

3. Best Practice Executive Summary

Describe briefly (max 10 lines) the GP context (partnership, funding, objectives, approach followed, results)

Founded in 2001, MikroElektronika (with 40 employees) produces now a wide range of development tools, compilers and books for PIC, dsPIC, AVR, 8051, ARM and PSoC microcontroller families. The company headquarter is located in Belgrade and production facilities in Lajkovac, Serbia.



The production facilities of MikroElektronika (www.mikroe.com) are equipped with true hole and SMD (surface mounting device) assembly technology. These two production lines enable the company to manufacture first class products with complete hardware and software solutions accompanied by printed manuals.

MikroElektronika is Microchip, Atmel AVR, Atmel 8051, Cypress PSoC and NPX ARM third party partner, as well as Telit Competence Center.



4. Best Practice Classification

Best Practice Theme

X Research Transformed to Innovative Product

- Research Transformed to Innovative Service
- Research Transformed to Innovative Methodology
- Research Transformed to Innovative Production Process
- Financial Mechanism for Transformation of Research to Innovation
- Support Mechanism for Transformation of Research to Innovation
- Other (describe)

Best Practice Research / Application Areas

- Industrial / Manufacturing Systems
 - Industrial Informatics and Communications
 - Intelligent Devices
 - Distributed Control Systems
 - Flexible Manufacturing Systems

X Embedded Systems

X Industrial Embedded Systems

- Nomadic Environments
- Private Spaces
- Public Infrastructures

5. Description of Best Practice

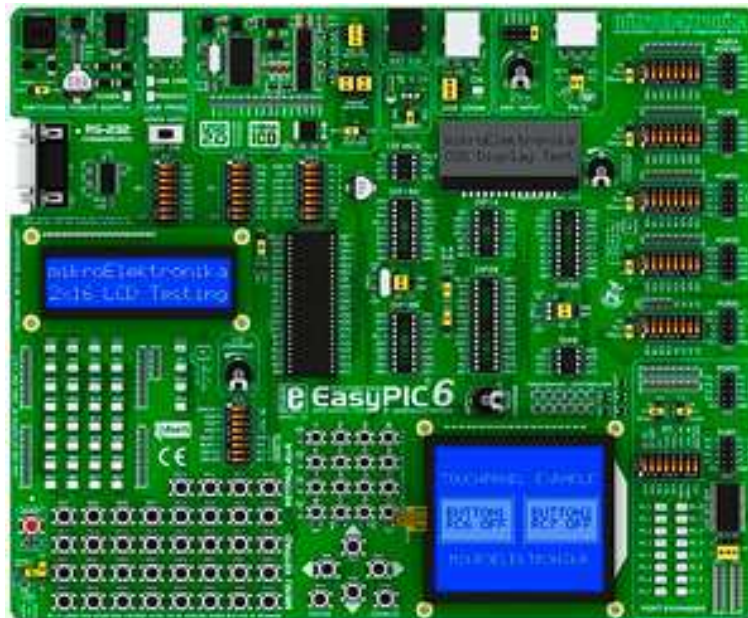
5.1 Best Practice Context

Overall background of the Best Practice. Location, socio-economic, technical & policy background of the BP (max 10 lines)

MikroElektronika has been one of the leaders on the market for development boards (PIC, dsPIC, AVR, 8051, ARM, PSoC) and compilers for almost 10 years. In house design and production over years make MikroElektronika experienced in designing complete and complex projects.

In addition to development boards for 8, 16 and 32 bit microcontrollers MikroElektronika produces many peripherals such as ADC, DAC, RS485, CAN, Ethernet, LCD, GLCD, TFT, IrDA, Accel, RTC, SD/MMC/CF, MP3, Digital potentiometer, LIN, motion sensors, RFID, ZIGBEE, Stepper motor driver and many others.

MikroElektronika's skilled programmers create with ease firmware for microcontrollers in C, Pascal and Basic programming languages as well as in Delphi and C++ for Windows OS.



Company's leading brand currently has it's sixth generation EasyPIC edition

5.1.1 Policy Elements

What are the policy initiatives that have influenced the contextual environment of BP: innovation promotion policies, research funding policies, certification ect as well as relevant tools (max 10 lines)

MikroElektronika is recognized by a world-wide audience right from the beginning. Company defined it's goals through slogan "making it simple", which depicts efforts to make products easy to use and suitable for beginners. Having international competitors, MikroElektronika had to make smart choices and evolved through constant user feedback. Each and every employee is encouraged to express creative ideas to his/hers superior, or to General Manager directly, making the flow of information transparent. Great ideas and achievements are awarded with bonuses to successful individuals and departments. Every month all employees gather for half an hour briefing, where General Manager presents company's monthly results. This helps employees to get the big picture: to understand their position and responsibility in the whole process, and to feel how great are their contributions to the overall company's achievements.

MikroElektronika invests a lot into organizational factors. It is company's policy to make working environment pleasant and safe and to introduce mechanisms that save worker's time. As of July 2010. company is certified with ISO9001:2008 certificate of Quality Management.

5.1.2 Socio-economic & Other factors

Other contextual factors such as customer / target market addressed, international validity, customer density, economic conditions, customer values, research area addressed (max 10 lines)

MikroElektronika products mainly target international microcontroller community: beginners, hobbyists, skilled enthusiasts, schools, students, and professionals. Company has become internationally famous and currently has distributors in over 38 countries. Vast majority of customers are from USA and Europe, followed by India, Brazil, Russia, Middle East and the rest of the world. Products are low-cost and are therefore meant for users from all economic categories.



*Airplane model.
All electronic has
been done with
MikroElektronika tools.*



*Shell contents, how many
kilometers you can drive
a car with one liter of
gasoline's. All electronic
has been done with
MikroElektronika tools.*

Good Practice Report

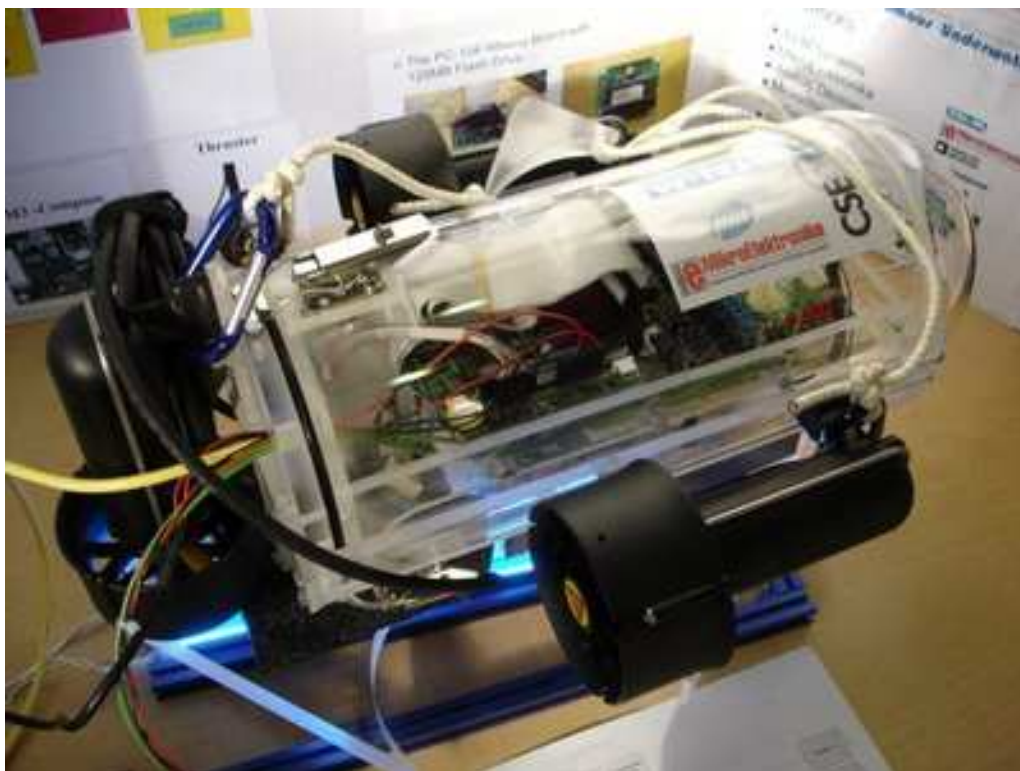


South pole, Penguin looking at mikroElektronika box.



'Institute polaire' uses MikroElektronika boards and compilers to make complex measurement on their expedition to South pole.

Good Practice Report



Submarine , done with MikroElektronika board and MikroC compiler.



Faculty Of Technical Sciences from Novi Sad, Serbia developing the device for the upcoming "Eurobot" competition.

Device is developed using EasyARM board from mikroElektronika

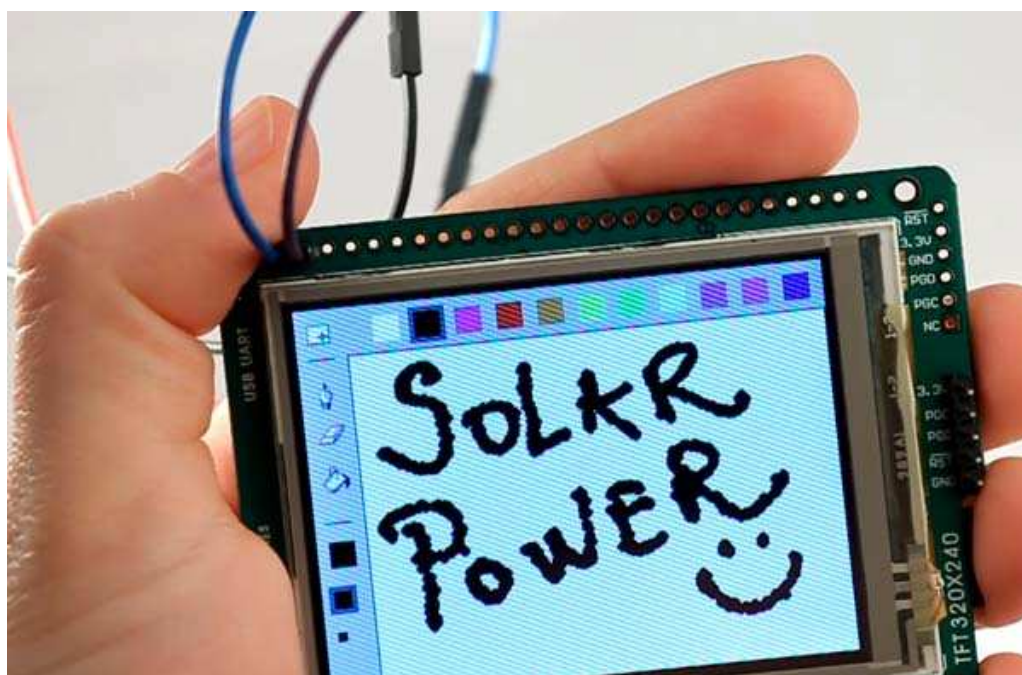
Good Practice Report



International Student competition Hardware and Software 2010 in Banja Luka, Bosnia and Herzegovina.

Radio controlled car that automatically follows the black line.

Project is done using MikroElektronika products.



"Paint" example running on mikroElektronika board powered with a light bulb and a four solar panels.

Good Practice Report



Project "Create Life" created with mikroElektronika boards and compiler.



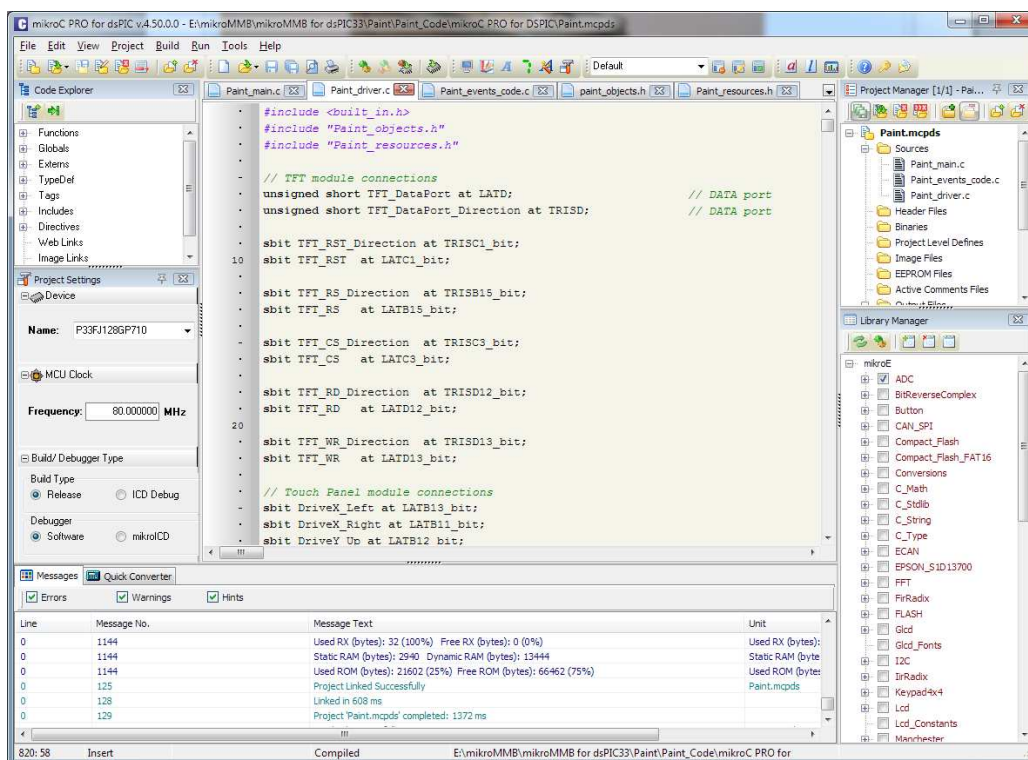
MikroElektronika is exhibitor at may international electronics fairs.

Picture: Booth at "Elettronica" fair, Munich, November 2008.

5.2 Objectives

Aim of the project, specific objectives & strategies to achieve these objectives (max 10 lines)

MikroElektronika started its activities in publishing sector through the own journal with the name “MikroElektronika”. Additionally, MikroElektronika has published several articles in some of the popular electronic magazines such as Elektor, Fare Elettronica, etc. Articles have a lot of useful information regarding development boards, compilers and other MikroElektronika products as well. These articles are available FREE for download and they are published in several languages. Examples given in articles are written in several compilers for various microcontrollers (PIC, dsPIC, AVR, 8051 etc.).



MikroElektronika's compilers are used in many educational facilities, universities and high-schools, as well as by renowned companies which develop firmware for their devices in compilers by MikroElektronika.

MikroElektronika provides in house design and production of software and hardware and therefore is capable of designing ready to use products including packaging and delivery to its customers as well. Such a way of doing business and providing assistance is the best guarantee of success as well as secrecy and safety for project details of its users.

6. Process

Describe the project including key concepts and the overall approach followed. Indicate project end users, target market, main project phases, problems encountered and solutions, problem resolution (max 10 lines)

One of recent projects was releasing company's new line of multimedia boards for Microchip PIC microcontrollers. After extensive market research, it has been found that multimedia capabilities are increasingly popular with microcontroller community. Several target groups were identified: absolute beginners, hobbyists, skilled enthusiasts and professional users. Each target group has different needs, but research team was able to separate common interests and differentiate what unique features each of the groups require.



New line of Multimedia Boards called "mikroMMB" are unique on the market. Exceptional design and wealth of on-board modules and features make the board extremely versatile.

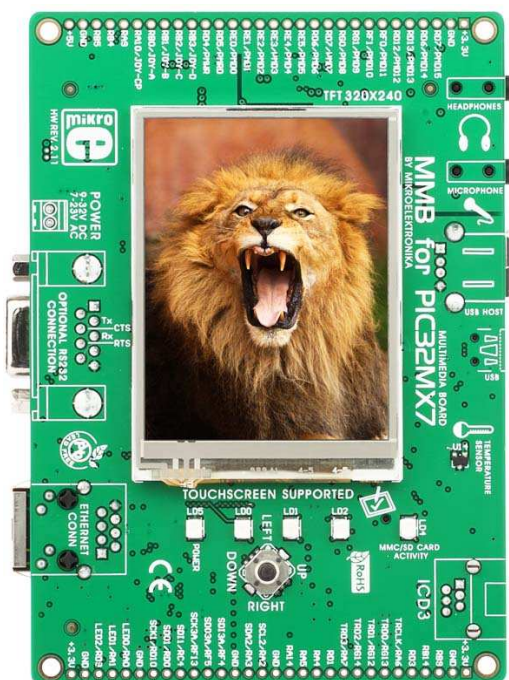
Project was initially divided into following phases: Market research, Prototype Design, Prototype Modeling, Prototype analysis and redesign, Producing final product, Promotional activities, Getting user feedback. Several device performance issues resulted in moderate redesign of some of the boards.

6.1 Project Design

Project design based on targeted market complete understanding, project structure, policies and procedures, management and implementation actions (max 10 lines)

Design of the boards had to obey several strict rules: each multimedia board had to combine all basic features that people nowadays associate with the word "multimedia". Therefore, Project Implementation Team incorporated TFT display with Touch screen, Audio codec and storage peripherals, such as MMC/SD card support and Serial Flash memory. Another rule of design was to make boards compact, mobile, light, easy to connect to other boards, and to be aesthetically of pleasant design. Nobody wants ergonomically impaired and big multimedia board, that is difficult to connect to additional modules and hard to carry in your pocket.

Team worked on the design of the first prototype for several weeks, taking it back to the drawing board after each iteration, always trying to move a step closer to the mention design criteria. Project leader was assigned to search for the best solution with hardware engineers, until all design aspects were fine tuned and a compromise solution has been reached.



Boards are designed to be beautiful and rich with features in the same time.

6.2 Project Management

Activities relevant to project coordination and management, project documentation and reporting, quality control, validation and verification (max 10 lines)

Project leader is the one defining project requests and creating the Project Plan. This document is the basic frame with general explanations and concepts, which is supposed to define guidelines for the project implementation. Project Implementation Team is then appointed by the General Manager. Project Implementation Team analyzes the Project Plan and suggests Project Implementation Plan, which is then approved by General Manager. Implementation is done in predefined number of steps, or checkpoints, and after each checkpoint Project Implementation Team officially reports the General Manager of the project progress. Each checkpoint is also a place where certain segments of the design can be reconsidered, and put back to redesign. Quality is controlled based on the checkpoint report document, and independent person is appointed for validation and verification of each project phase.



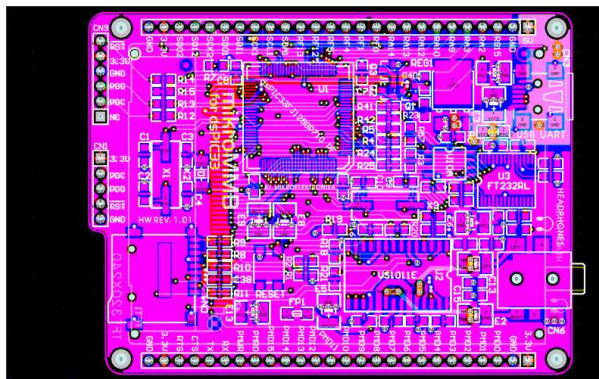
General Manager of mikroElektronika with a Tea cup with company's new Multimedial Boards printed on the side

6.3 Project Implementation

Main elements associated with the project implementation. Realization of new idea, or new technological realization or improvement / novelty to known technology and means to achieve this. Innovation associated with the project realization in terms of new products, services, methodologies. Marketing, advertising and customer service. (max 10 lines)

When certain level of design, which complies best with initial guidelines, has been reached, board goes into production. High quality SMD components are used, along on 4-layer PCB which guarantees low noise and low induction from external sources. Marketing team is then appointed to create a campaign concept in order to promote the product as best as possible. Promotional material includes website page, community websites, news announcements and teasers, as well as advertisements in popular newspapers that address target groups.

Good Practice Report



When the design is defined by the Project Team, board is being engineered and prepared for production.

6.4 Project Evaluation

Project feedback mechanisms and evaluation mechanisms. (max 10 lines)

Customer feedback is received through information on webpage visitors count, number of boards sold, and through customer support requests on Forums, E-mails and Support Tickets. These information are then carefully analyzed in order to determine how each marketing segment contributes to the sales rate of the product. Company tends to activate community in order to get more examples of implementation of the boards in different context. Potential customers more easily decide to buy if they are presented with great examples and are inspired by cool projects from other users.

When enough feedback is collected, project is evaluated and Project Implementation Team creates the official Report of Success which is sent to General Manager for approval.

7. Description of Research team/Institution

Short description of R&D team and institution (max. 10 lines)

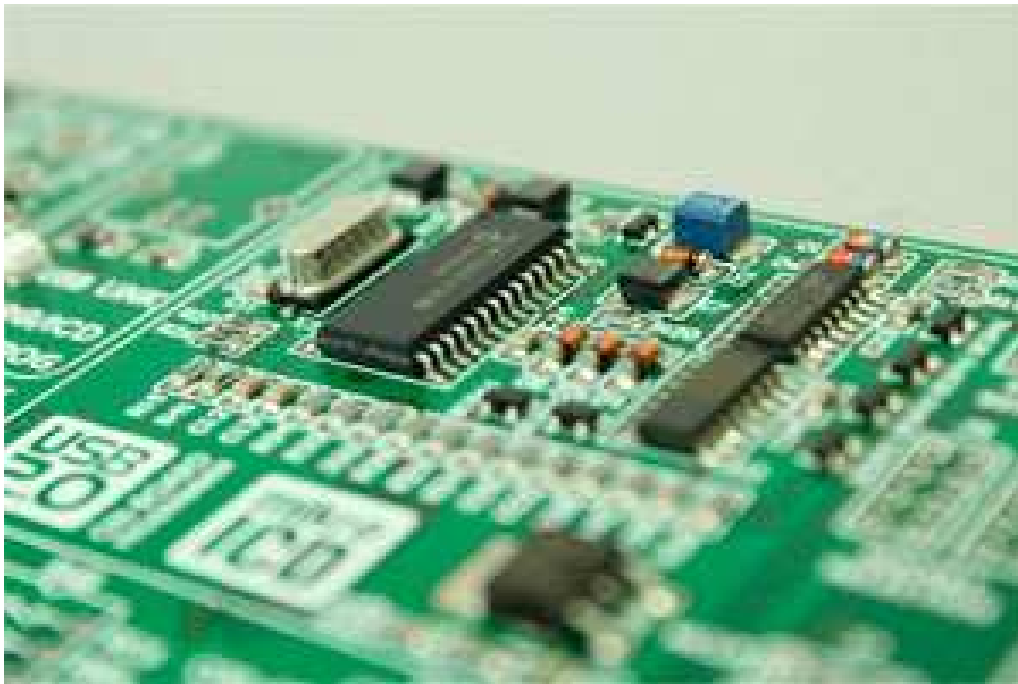
MikroElektronika was founded in 2001, firstly as a publishing company, specializing in electronics. Since then, this team has significantly advanced and expanded the field of activity. The main areas of interest are: Developer Tools, Compilers, Journal and Books.

Two manufacturing lines with automatic soldering of electronic components enable increasing of the products quality. The most part of the products (98 % of the monthly production) is intended to export in more than 25 countries all over the world. The company sells around 300 products annually and has annual income approximately 2 million EUR.



Average age of employees in mikroElektronika is 30

Good Practice Report



MikroElektronika implements only the best quality in production process. Investment of half a million Euro in new equipment was paid off in a short period.



Chief of Production Department shows the principles of SMD technology to other colleagues. Judging by the look on their faces, employees were very pleased with the operation of SMD machines.

Today, MikroElektronika, has 40 employees (the average age of the team is 30).

MikroElektronika is a member of the Embedded.rs cluster.

8. Applied Financial Mechanism

Describe financial mechanisms applied in transformation of research into innovation within BP, as well as means of connecting scientific research team and financiers (max. 1000 char.)

Financial mechanism applied in transformation of research into innovation is private funding. The company was established by Nebojša Matić, an electrical engineer, first in his own house and after that expanding every year.

Afterwards, Nebojša Matić has invested capital in booth lead free true hole and lead free SMD line with brand new machines from ERSA and Europlacer. The present equipment enables work up to 0.3mm pitch.



New production line with Europlacer machines at mikroElektronika production facility

9. Impact and benefits

Describe achieved benefits of R&D team and/or enterprise implemented innovation, as well as impacts on institutional and policy levels. (max. 1000 char.)

MikroElektronika delivers development tools worldwide and many satisfied customers guarantee first class service. At institutional level important benefits will be achieved through strategic partnership with leading companies in the field such as Microchip, Cypress Semiconductors, Sony, etc.

MikroElektronika have a huge market in the field of developing C, BASIC, and Pascal compilers for PIC, dsPIC, AVR and other microcontrollers. Every year, expanding the offer, following market trends.

MikroElektronika also publishes interesting books such as "Programming language BASIC for PIC microcontrollers", "PIC Microcontrollers", "Introduction to industrial PLC controllers", "Radio receivers", etc. Most of the published book was translated into English, and some of the titles are available for viewing and downloading via the Internet, completely free.

Good Practice Report



10. Sustainability

Provide information on sustainability of innovation after financial aid within implemented financial mechanisms, and some multiplier effects as replication and extension of the action performed in BP. Expected use of Best Practice and lifecycle considerations. (max. 1000 char.)

The first class products of MikroElektronika with complete hardware and software solutions including printed manuals are delivered all over the world. Compilers (mikroBasic, mikroPascal and mikroC) offer a wealth of libraries which simplify the initialization and use of microcontrollers and their modules. MikroElektronika constantly improves its development solutions to better suite the needs of its users, regardless of whether they are beginners or experienced users.

Partnership with well-known companies such as Microchip, Atmel, Cypress and ARM is very important factor in extension of the existing market and will guarantee long-lasting sustainability and financial stability of MikroElektronika company.



Well known companies recognize MikroElektronika as a good partner in bussiness

11. Repeatability and transferability

Lessons learned from the project implementation team. Repeatability and transferability of the project. (max. 1000 char.)

Project Implementation Team tends to spend less resources each time a new project is being done. Company is willing to spend reasonable amount of time and money initially, searching for best solutions and components that are used in production, but then tends to reuse those created modules in future products. A simple pattern is followed: rely on existing technology and good practices for current projects and updates, and radically innovate only for radically new products. Investing into major redesign each time the new version of the same product is being released turned out to be a waste of resources.

What is MMB for dsPIC33?	Why is this board great for me?	Documentation
<p>This board provides a compact high-quality multimedia development platform for dsPIC33 devices. It has numerous on-board modules, that allow you to write multimedia applications. This board can be used for both development or as a final product.</p> <p>Programming and debugging On-board dsPIC33 can be programmed and debugged by using the External programmer (LVPICFlash with mikroICD).</p> <p>Connectivity All microcontroller pins are available through breakout pads, so you can easily connect other peripherals with your board.</p>	<ul style="list-style-type: none"> ✓ Audio and Video Ready Large 320x240 TFT Color Display with Touch Screen and Stereo MP3 Codec chip with great performance give you true power to build full multimedia applications. ✓ Compact and great-looking Board is carefully designed and is very compact and handy. We have used the highest quality components and 4-layer PCB to achieve maximum efficiency. 	<p>English</p> <ul style="list-style-type: none"> ✓ mikroMMB for dsPIC33 Board Schematic[4.10MB] ✓ mikroMMB for dsPIC33 User Manual[3.73MB] <p>Español</p> <p>Featured Products</p> <ul style="list-style-type: none"> ✓ mikroC PRO for dsPIC30/33 and PIC24

Investing in website redesign is only performed when new products come along. After the new idea emerges, the webpage template is then used for all similar pages (old and future ones)

12. Evaluation

Describe reasons and evaluation criteria why the described example is a best practice. (max. 1000 char.)

There is no modern device, from mobile phone to space shuttle without microcontrollers inside. The MikroElektronika company exports more than 300 high tech products, based on microcontrollers, to over 25 countries worldwide. With two production facilities and with partnership with many successful companies in the world, this company represents a really good example in this region. MikroElektronika produces a wide range of development tools and compilers for various microcontroller families based on own knowledge and experience (in hardware, software and mechanical design with successful track record of GSM/GPRS designs). Additionally, highly-skilled staff offers experience in designing cost effective and reliable end solutions. An important criteria why the described example is a good practice is a number of own published books in the field of microcontrollers and their application.

Exceptional organizational structure of the company, high standards of quality and good mechanisms of control are an example to young emerging firms to be followed in the path of success.

Good Practice Report

13. Contact of research team/institution	14. Contact of financial mechanism facilitator
<i>Name, address, tel., fax, e-mail, URL</i>	<i>Name, address, tel., fax, e-mail, URL</i>
<p>Nebojša Matić MikroElektronika Višegradska 1A 11000 Belgrade Serbia</p> <p>Phone: +381 11 366 0 337 Fax: +381 11 366 0 601 e-mail: matic@mikroe.com http://www.mikroe.com</p>	<p>Biljana Vukašinić, financial manager MikroElektronika Višegradska 1A 11000 Belgrade Serbia</p> <p>Phone: +381 11 366 0 337 Fax: +381 11 366 0 601 e-mail: matic@mikroe.com http://www.mikroe.com</p>