



PROJECT ABSTRACTS

Austria

1: Development of a completely new electro-thermo-mechanical De-Icing system for aircraft

The advanced de-ice system was planned by Michael Kaiser and Johannes Kienl in cooperation with two offices of technical engineers. It can be used to de-ice all important airfoils of aircraft and wind power stations. The device can be attached to an aircraft's wings, vertical and horizontal stabilizers and the rotors of wind power stations.

Expansion of a heated metal layer is used to push the existing ice off the wings of an airplane. So heat and power are only required when ice exists. That's the biggest difference to conventional anti-ice systems. One of these systems -called "Bleed Air System"- has to heat the airfoils constantly and always requires power, when the airplane is in danger zones. The advanced de-icing system has advantages in weight, dimensions, efficiency and the power required.

2: DSP-implementation of a discrete modulation for lowest frequencies "Making a complete ECG-signal audible"

In this project a device has been developed that makes the complete electro-cardio-graphic signal (ECG-signal) audible. For the human ear it is not possible to hear frequencies lower than 12 Hz, so the frequency multiplication and the double-side-band modulation with suppressed carrier are used to modulate the signal into an audible frequency range. As our device makes the complete ECG signal audible, it is possible to distinguish between heart-rhythm-disorders, ventricular fibrillation, lack of electrical arousal and normal heart function immediately, just by hearing the signals. It is now possible to hear the complete ECG signal via headphones or speaker.

3: Playing material to promote the cognitive, visual, tactile and sensomotoric development of infants and toddlers

"Geoklett", is a simple set of geometric figures that was designed to promote the cognitive, visual, tactile and sensomotoric skills of infants and disabled children at a higher age. As playing with this new material also improves emotional and social competence, "Geoklett" also supports development in children with various behavioural problems. Especially in multicultural pre-schools where the infants speak entirely different languages, the "Geoklett" enables communication and the ability to learn foreign words. Some observations of the applied use of "Geoklett" suggest that the product may also assist in the rehabilitation and

development of adults with neurological disorders. This possibility will be investigated in the future.

Belarus

1: The Possibility of Orbit Changing for Small Bodies of the Solar System

In this project the nature of orbit changing for small bodies of the Solar System was investigated on the example of Phobos, which is the moon of Mars.

The provided model of orbits changing for the small bodies of the solar system may be used to guarantee the protection to the Earth from asteroid danger as it gives an opportunity to calculate the parameters of the impact which are necessary for a certain changing of the orbit

2: The research of the force of friction between a thread and a pivot

The aim of my research was studying the influence of the force of friction between a pivot and a thread on different processes. The question arises while solving a series of traditional physical problems on mechanics.

A detailed research of the demonstration of the experiment, named "Stopper", has been done. The system of the equations describing the phenomenon has been suggested. On the basis of this system a computer model named "Borders of the effect", consisting of two computer programs has been constructed.

3: Modelling objects in three-dimensional graphics and visualization using hardware

The main aim of my project was to develop the Editor and a Visualizer of photorealistic three-dimensional graphics using hardware for modelling process of the image construction in architectural designing systems. The possibility of 3D images creation in real time with photorealistic quality graphics close to 3D studio max, 3D maya renders has appeared. There is an opportunity to create any architectural object and see how it will look in reality.

Belgium

1: The pluviometer – a new quantitative and qualitative measurement instrument for rainwater

This project was set up in the framework of a school project about weather and climate; Latifa, Nadia and Fernand designed a pluviometer able to measure precipitation drop by drop in real time, as well as, to determine the rainwater conductivity. From these high-resolution pluviometric measurements, they are able to assess the rainwater quality and its evolution during a rainfall. By several experiences, they demonstrate that their new instrument, called Pluvioscan, is able, in addition to a precise measurement of the precipitation, to distinguish different types of rainwater. Latifa, Nadia and Fernand are convinced of the Pluvioscan value for ecology studies and agriculture applications.

Bulgaria

1: Virtual Chemistry Laboratory

The aim of this project is to create a virtual Chemistry laboratory to help students in their first year of studying Chemistry and their teachers, as well. There are already some online helpers and virtual labs developed in the Internet, but most of them are restricted to visualizing a particular reaction or a separate process and the universal ones are developed for university students of chemistry and are extremely hard to use. What's more, most of those applications are shareware and require licensing, which is not affordable for most schools and for the average seventh-grader. The project is aimed at a specific group of users, which makes it far better for its purpose than universal laboratories. Using this program, students acquire basic skills and knowledge for work in a laboratory without the risk of incidents in a real laboratory. Users have the option to check their skills and knowledge in an unconventional and entertaining way.

2: Numerical studies of two dimensional gravity waves of inviscid fluids in channel

This project studies the dynamics of two-dimensional gravity waves of the free surface of an inviscid incompressible fluid in a rectangular channel. The flow inside the fluid is assumed to be irrotational and is described in terms of the single-value harmonic potential. We combine in our study the model of dissipation along the triple fluid/fluid/solid contact line, suggested by Blake and Haynes (*J. Colloid Interface Sci.* 30 (1969) 421-423) and the model of viscous dissipation, suggested by Jiang and co-authors (*J. Fluid Mech.* 329 (1996) 277- 307). Both models are phenomenological and assume that when a fluid particle moves a friction force proportional to the particle velocity acts on it which impedes its motion. We consider also the case when in addition to the gravitation on the fluid acts an external periodic force. The main element of the scheme we developed is calculation of the harmonic potential. This method can be applied for determination of the friction coefficients and can be used to study the wetting dynamics effects in microfluidics devices.

3: A method of measurement of refractive indices, birefringence and thickness of a thin anisotropic layer

The aim of the project is to improve the quality of high - technology products like optical polarizer and compensator for liquid crystal displays (LCD). Keeping in mind that the production of polarizers and compensators is more than few million square meters per year and that prices are about 12% from the LCD's price, the problem of their high quality manufacturing is very important.

To perform a fast quality evaluation during the manufacturing process, the method of measurement of the main characteristics - refractive indices, birefringence and thickness – has to allow real time measurement. The method developed in this project satisfies these requirements. The goal of the project is to develop a fast and accurate method of measurement of refractive indices, birefringence and thickness of thin anisotropic layer.

China

1: The Study of a “Reusable Novel Paper” for Calligraphy and Painting Exercises-The Application of Nanotechnology for the Calligraphy and Painting Material Preparation

Since ancient times, Chinese people have always practiced penmanship and painting with Chinese ink, which consumes considerable traditional paper and natural resources. To avoid abuse, the author developed a novel material to substitute the Chinese ink and traditional paper used for calligraphy and painting. After doing market research, making some consulting references, and many tests, the TiO₂ nano particles are obtained from low-cost raw materials by means of certain chemical reactions. Then, they are mixed with Al₂O₃ superfine particles and polyacrylate to obtain a coating paste that is evenly coated on the coloured fabric to make the “novel paper”, which is still fine after being used repeatedly more than 800 times. The cost of this “novel paper” is very low. When people do calligraphic and painting exercises on it with a soft pen or brush pan dipped water, wet handwriting is brilliant and subsists for a long time.

2: Research on the Technology of the Crack Inspection Based on Conductive Paint

An automatic crack inspection system to locate the appearance position of the crack and monitor the development of the crack in the concrete and steel structure is invented. This new technology is realized by the “magic conductive paint”, which is used as the material to adhere to the surface of the structure. When the structure is loaded, the resistance of the conductive paint will change. And if the crack appears, the resistance will change dramatically. There are two advantages of this system: firstly, each conductive paint layer can monitor as large as the scope of 2 meters, it is an economical and distributive inspection method; secondly, it can monitor the overall process of the crack development, while other gauges will be damaged as soon as the crack appears. This system can be used to inspect the cracks in constructions like bridges and houses.

3: Double Function Solar Energy Thermal Power “Household Power Station”

Light-generated electricity is to transform solar energy into electricity directly via silicon photocell using photoelectric effect. It’s not commercially prevalent due to the high cost. At present, the commonly used solar water heater can only be used for shower because of its light/heat transformation mode. However, the dual use solar thermal “household power station” will change this transformation mode into light/heat/electricity. In this case, in addition to shower, the hot water generated by the solar water heater can also be used as heat reservoir. The mixture with a low boiling point will first be vaporized, then enters the steam turbine and does the expansion work. Finally, it will drive the generator to work. The whole system works on an independent generator system. The innovative element introduced into the system is the steam turbine. It doesn’t require a high speed turbine and obtains a safe and reliable generation of electricity.

Czech Republic

1: Prisoners Dilemma and Self-Learning Algorithms

Not all self-learning algorithms are equal. Some can find optimal solutions faster than others; some are able to give outstanding results in specific cases. This project is about comparison of

such algorithms based on their ability to survive in population, where everyone can work in harness with the others, abuse others help or fight with the others. This work not only confirms some already known phenomena (the cycling of TFT and All D) but also brings some new views on the problem. Most notably, the comparison of four principles and an engine usable for ongoing simulations was made. The question is now: what will these algorithms analyze as the best possibility?

2: Central Electronics Security and Surveillance Unit EZS1 v 2.00

In this project, a summary of today's security systems is outlined and a micro controller is applied to a well defined and practical construction of unit EZS 1. This unit is constructed as a small low-cost security system with professional features for small or middle-sized objects. A unique solution; anti tamper protection and low purchase cost enable to use EZS 1 in the frame of a small family house as well as in offices, where are high-level safety requirements exist. EZS 1 can be connected to the internet and GSM network for sending information (SMS, emails etc.) on status and disturbance throughout the world. Standard sensors can be connected to units thanks to an impedance sensitive loop. The programme consists of the technical documentation, software and service instructions. EZS 1 is a professional solution with unique anti tamper protection and stable software for safety.

3: Use of digital photography for assessment of wheat leaf colour changes

In this study, a new method was developed to assess the ageing of plants. Therefore, a new parameter was created: $\Sigma L+a$ which describes changes of the green colour in leaves. Statistically highly significant differences were found in $\Sigma L+a$ levels under the influence of all factors. The $\Sigma L+a$ levels of fully physiologically active leaves could be found between 10.0–20.0, the first changes due to the ageing indicate levels between 25.0–40.0, more significant ageing was characterized with the increase of levels up to 50.0–60.0 and finally dead leaves with no green colour had $\Sigma L+a$ near 80.0.

Using this highly sensitive method based on assessment of the pixel colour we can indicate even initial changes of leaf colour. It gives new possibilities to create wheat (crop) genotypes with required properties.

Denmark

1: Complex Chemistry – a World of Possibilities

Life would not exist without complexes: they catch the energy from the sun and carry oxygen around in our blood. Their chemistry is both exciting, giving a deep insight into the dynamic structure of the atom and colourful because they absorb light in the visible spectrum.

In this study we devised a few simple experiments where complexes are formed that can open doors into the magical world where solutions change colour because of temperature or concentration. We also formulated a few simple rules which explain complex nomenclature and illustrated orbital splitting and how this relates to existing complex theory. Finally, the project illustrates how a basic knowledge of complex chemistry can help to predict the structure of unknown complexes synthesized from a Dutch nickel coin. There is of course also a wealth of practical applications for these complexes: treatment of cancer or new means to store energy.

2: A New Plant Based Drug against Cancer – the Effect on the Cell Membrane

Cell membranes are the gateways for many essential processes in our bodies and they are also the site where most drugs work. This study investigates the way in which an anti-cancer drug, developed from a traditional medicine, interacts with the cell membrane at the molecular level. This was done by making synthetic membranes with the anti-cancer drug and then used atomic force microscopy and differential scanning calorimetry to investigate the interactions. Three different types of interaction were discovered, two of which appeared to be related by a gradual transition. Next the various mechanisms involved in the metastatic spread of cancer were reviewed. The aim is to understand the mechanism as a step towards finding an even more effective treatment. An effective block for the spread of cancer has the potential to be effective for many types of cancer and thus has an enormous value – both to relieve human suffering and as a commercial product.

3: Purification of Water with Active Carbon Made from Nutshells

One person in 20 in the world does not have access to clean drinking water. The lack of this basic need gives rise to a whole series of consequences: diseases, morbidity, death, loss of earning ability all leading to poverty in its widest sense. We have investigated one possible solution to this: to use active carbon to purify water because its capacity to bind to a wide range of compounds would be an ideal characteristic for water purification systems since it would need only one filtration step. We have identified a source of active carbon – from nutshells – and have demonstrated that it is four times more effective than the active carbon which is commercially used today. The solution is simple; it requires only basic technology and does not require electricity. We have shown that the filter does not breakdown despite the large volumes of water passed through it. The active carbon filter is also effective and will absorb many times its own weight of pollutants. Our active carbon solution to purify water could be used in any country and could give clean water to all

Estonia

1: The effect of environmental knowledge on personal interests and self-assessment of Estonian compulsory school

This research considers the awareness of 9th grade Estonian students about sustainable development and their readiness to contribute to the improvement of the environment. Our research is based on a large, representative and reliable empirical study that demonstrates the need to change all systems of environmental education in Estonia. The research indicated that we urgently need a new approach to the environmental education in Estonia. The existence of environmental science as a separate teaching subject in our schools is essential because only in this way can students obtain a comprehensive understanding of the environment and sustainable development. Having the environment and ecology as recurrent themes in the national curriculum is unjustified since the integration of different natural sciences is still low.

2: Viviparous Blenny (or viviparous eelpout) (*Zoarces viviparus*) as an indicator of pollution of the Gulf of Riga

Viviparous blenny (*Zoarces viviparus*) is the only fish in the Baltic Sea that gives birth to live fry and has been proved to have internal fertilization. Viviparous blenny's unique reproduction makes it one of the most important indicators of pollution in the Baltic Sea.

The Baltic Sea is one of the most polluted seas in the world. In the research we tried to approximate pollution of the Gulf of Riga by the condition of the viviparous blenny's fry. During the study, 85 female viviparous blenny caught from the Gulf of Riga were analysed and mortality rate of 2145 fish fry was studied. Absolute fertility of 85 specimens and relative fertility of 29 specimens was established. Mortality of viviparous blenny's fry was as high as 77.3%. This indicates heavy pollution in the Gulf of Riga

European Schools

1: Spectator anions alter the rate and mechanism of a reaction between magnesium and acid.

This project demonstrates that spectator ions, chemical species that have been generally considered to have no involvement in simple reactions such as those occurring between an acid and a metal, do, on the contrary, have a significant impact on the reaction by modifying the mechanism by which the reaction takes place. The research done here suggests that negative ions surrounding the metal can both inhibit the reaction and reduce the energy barrier that needs to be overcome when an acid particle (hydroxonium ion) interacts with the metal.

Finland

1: A passive sound-based method to determine the velocity of a moving object

In this project a passive method to determine the velocity of a moving sound source was developed, based on the exclusive use of emitted sound. The Java programming language was used to produce a sound analysis program that exclusively uses a sound file in the WAV form as its input. The various sound frequencies used for speed determination are extracted using the fast Fourier Transform (FFT) algorithm, which is a conventional digital sound signal processing tool. At the program development and testing phases, a motorcar was used as an example. As a result of the project, a completely passive sensor was developed, which enables to monitor an object without it being aware of being observed.

France

1: A thermometer lens for adaptive optics

A mirage is a natural optics phenomenon. Basically there are two kinds of mirages: inferior and superior. In this project, we studied mirages theoretically, and then tried to produce some experimentally. This study led us to develop a new kind of adaptive optics lens which we believe could be used in lens telescopes. Moreover, this lens is at the same time a thermometer!

2: Thermoelectricity, how to improve the efficiency of engines and save energy

The idea behind this project is to employ heat wasted away by engines to produce electricity and save energy. We discovered that nature has "invented" a mechanism to do what we wanted. This mechanism was discovered by Seebeck, a German physicist, in the 1820's. This in mind, we experimented with thermoelectric "modules" sandwiched between two aluminium blocks, one of which was heated, the other cooled. Our aim was to see how much electricity can be generated this way.

Georgia

1: How to Avoid the Alternative Interpretation of the Cerebral Blood Flow Data of the Ultrasonic Diagnostics

The estimation of the cerebral blood flow condition by the method of the ultrasonic transcranial dopplerography of the brain vessels is carried out on the basis of the blood flow velocity data with special attention to the symmetry/asymmetry of the blood flow in the same name vessels of the hemispheres. But the absence of a standard of the estimation of the blood flow decrease/increase leads to a subjective interpretation of the data.

The aim of this study is the introduction of the blood flow decrease (BFDI) and increase (BFII) indices into the potential of the qualitative-quantitative characteristics of the cerebral haemodynamics in order to standardize the diagnostics data.

2: Influence of Arsenic – Polluted Soil on Children and Adolescents

In this project the morbidity of school children living in the Lukhuni gorge (high mountain region in Georgia) under Arsenic influence was studied.

In the zone of Arsenic influence the number of school age children and adolescents manifesting persistent deviations in health is authentically increased, as well as the frequency of visits to doctors and the incidence of acute respiratory and other infections. It was found that the increased number of micronuclei (MN) in buccal exfoliative cells in children and adolescents caused by Arsenic pollution correlates with the levels of environmental pollution.

3: Study of the Physiological and Reparative Regeneration of Liver (Hepatopancreas) of Helix Lucorum.

The reparative regeneration of hepatopancreas of gastropoda mollusk *Helix lucorum* has been studied in this project. It has been shown that the gene reprogramming is proceeded within the hepato-pancreas cells on the primary stage of reparative growth likewise rodents. The first transcriptional activity peak arises at the ninth hour after operation. The first mitoses appear after 24 hour from resection and organ mass restitution is completed in a week. It is established that the main cell types ratio within the hepato-pancreas lobules of adult and growing individuals equals to 8:1:1, which is not changed during the reparative regeneration. The small sized ($d \sim 8.5 \mu\text{m}$) acidophilic cells have been revealed within the hepato-pancreas globules, function of which is not estimated yet. It has been shown that the storage of muco- and glycoproteins takes place within these acidophilic cells.

Germany

1: Radial velocity measurement of spectroscopic binaries

In modern astronomy high resolution spectrographs are used at most of the observatories. With the help of the doppler shift effect one even can say with what velocity a star or a galaxy moves in relation to the earth. In this treatise, Thomas Gigl proved these so called radial velocities, but on the basis of a self-made, fibre coupled spectrograph at spectroscopic binaries. For this purpose, he built his own high resolution spectrograph called HASE (hare) for astronomic observations. To this end he honed and polished the ends of a glass fibre in the kitchen of his mother, connected the HASE with his own telescope, built his own guider and

was thus able to observe the rotation of twin stars which show in the telescope only as a single light dot. With this work, Thomas shows that it is possible for amateur astronomers to build a high resolution spectrograph with which you can take radial velocity curves of spectroscopic binaries.

2: Climatic Differences in the Region of Hildesheim

Nothing is more exciting than observing the sea and luff and lee. Denis Moeller started observing and logging the weather in his home region around Hildesheim (Lower Saxony, Germany) at the early age of six, influenced by his grandfather who was the weather expert in his small home village. Now he was able to identify significant microclimatic effects of the relief. Using a combination of traditional and sophisticated computer-aided methods he systematically recorded the small-sized differences and, at the same time, showed the impact of different land use and land cover systems on the local climate.

3: Flight curves of table tennis balls

Table-tennis probably is one of the fastest sports in the world for both players and spectators. How professionals nevertheless manage to place balls exactly on the edge of the table and how they put pressure on their opponent with topspins as hard as nails, fascinated J. Burkart and A. Joos. Their project aims to physically understand and simulate the curve of the flying ball. At the beginning of their work the young scientists analysed those balls coming out of a training machine with a computer and found out that even loopings were possible. Eventually, they compared flight curve experiments and simulated trajectories and found an excellent agreement. The thereby verified simulation, made it possible to imitate several real table-tennis situations.

Hungary

1: New method to define the errors of the apoptosis

The aim of the project was to find an alternate, new method defining an unusual disease. The nature of this disease is in the error of the Fas-ligand induced apoptosis. This research was not done by anybody else before. This alternative method can be easily used in practice. We can define the lack of the Fas-ligand production in the apoptosis program, this Fas-ligand is essential for the correct function of the Fas-ligand induced apoptosis. The method can be performed in a short time; we achieved time reduction by speeding up the marking period, and used cell-markers in a higher concentration. Our further aim is to achieve more time reduction, to make our method faster.

2: Transneuronal viral tract-tracing: computer assistance and 3D modelling

Micrographs obtained in previous, transneuronal viral-tract-tracing experiments were used to reconstruct autonomic brain nuclei of different organs, in 3D form, by LightWave3D (NewTek) software. Compared to former documentations – generally represented in 2D form – the present development resulted in clear, comprehensible and accurate simultaneous 3D presentation of several separate experimental observations, i.e., in a “virtual brain”. In the present work the central autonomic nuclei of parotid gland in the brainstem are presented in 3D form, while the “virtual brain” is constantly updated. We have completed our work by

construction of an on-line literature database. The software developed will be available and free to download to the scientific community after completion.

3: Compass implemented on a mobile phone

Are you going off for an excursion and have no compass? Want to know when sun and moon rises or sets, or what phase the moon shows? Want to know the direction towards your home or even Mecca? Are you kidnapped and want to know where you are? All of that is possible by downloading this software to your mobile phone! This JAVA application requires only 150 kBytes and is applicable for almost all colour display mobile phones. It displays a Compass with 3 orienting arrows: orange, blue and black pointing towards the sun, moon and e.g. Mecca. If you want to know what time the sun (or moon) rises today or any selected day wherever you are: you get the answer. You can determine your position by measuring the angle of sunbeams or moon-rays with the internal angle gauge!

Ireland

1: The Development and Evaluation of a Biological Food Spoilage Indicator.

Food poisoning caused by the consumption of spoiled food has led to many cases of illness and in some cases contamination by pathogens has led to deaths. This project involves the development and evaluation of a biological indicator to anticipate food spoilage. The system developed is based on the life cycle of harmless bacteria, *Lactococcus Lactis*. The growth rate of *L. Lactis* cultures at different temperatures was determined. Subsequently the appropriate concentrations of *L. Lactis* and a special nutrient was determined to achieve a particular colour change while replicating the increase in bacterial growth expected when food spoils. The results of this project demonstrated that the spoilage indicator was both effective and commercially viable.

Israel

1: Sentence completion using a learning Algorithm

The purpose of the project is to optimise the typing process by using a Markov chain model in order to guess what the next word the user is going to type will be. The algorithm builds and uses a tree-like data-structure that contains the number of times a certain word appeared in total, and also the different contexts the word has appeared in and how many times it appeared in them. The system is built in a way that it will not interrupt the user while he types, and would let him continue typing if he chooses not to accept the suggestion without any slow down. In addition, the system will purge itself from words that have been rarely used in order to ease the resource strain on the computer.

2: Estimating the age of water in aquifers

To improve life on earth we need water. But to use water intelligently we want to know how old the water is that we are using. If the water is young then we will soon get more water. If it is old then more water will come very slowly. It is possible to use radiocarbon to calculate the age of water in aquifer up to several thousands of years. Radiocarbon is radioactive and can be used as a clock, but it is not known with how much radiocarbon enters into an aquifer. We found a way to improve the calculation

of age by investigating gases in the unsaturated zone which water has to pass on the way to the aquifer. Using our results we calculated the age of a well to be 2010 years, while if no correction is used, the age is 7009 years.

3: Application of Superconducting Levitation for Transporting Object without Contamination.

Many manufacturers of micro products today have a need for absolutely sterile conditions in their factories. When computer chips are made, for example, even one small particle of dust can cause a production flaw and, consequently, heavy financial losses for the company. Conventional methods of removing existing contaminants are not sufficient. In devising our solution, we viewed the problem in an entirely different way: Rather than remove dust and other contaminants, why not prevent their presence in the first place? Our method is to use the levitation effect of superconductors at high temperatures, together with magnets, in order to transfer the product without it coming into direct contact with the assembly line. In the course of our research, we explored superconductors and the levitation effect on theoretical and practical levels in order to assess the viability of our solution.

Italy

1: New strategies for legionella prevention in warm sanitary water of plumbing systems

The project started with a study carried out by the National Institute of Health which showed an increase in cases of pneumonias due to Legionella.

Different methods (like hyperchloration and shock temperature) had been adopted to solve this problem, but a return of the contamination was observed about 12 – 24 months after the reclamation. For this reason the students decided to invent a new prototype based on the use of different techniques, combining together chemical and physical methods and new technical solutions, considering both costs and benefits.

The results obtained demonstrate the effectiveness of the methods in eradicating the pathogenic completely. These findings allowed creating a new cheaper prototype, more efficient than those currently on the market.

2: The Digital “Bobby” An approach to computer-aided traffic control

This paper describes the development of innovative software to monitor traffic on streets and roadways, and track individual vehicles using a digital camera. The software analyzes data from a video camera overlooking the roadway and recording the transit of vehicles. The real-time analysis shows a variety of traffic violations. Furthermore, by selecting the best method for detecting objects in motion on a frame-by-frame basis, the software has been shown to be reliable in adapting itself to different weather and lighting conditions. Finally, a variety of scenarios can be envisaged for developing such a system in other contexts (for example, incipient forest fire detection).

Japan

1: The study of air column of water flow.

I happened to find a bulge made under the flow water when I washed a spoon. I called it the air column of water flow. The shape of the air column is the result of the relations between the

speed of flow and the maximum amount of air infusion. And the strength of it depends on the temperature of the water. The air column of water flow in higher temperature could last longer than that of lower temperature. In other words, high temperature air column is more stable than the lower temperature air column. Standing waves found in the air column affects the stability of it. At higher temperature, the standing waves move up because of air convection which has been made by high temperature.

Latvia

1: A High Density Nanoelectromechanical Device

Nanotechnologies are being explored all over the world, however, there is still a lot to be done. Kristine wanted to contribute to these researches with her project about devices made on nanoscale. Till now, there have been built nanodevices based on single nanowires where the nanowire can turn the device on or off when voltage is applied. However, to use this principle in electronics, it would be necessary to acquire a device consisting of numerous nanowires. Kristine built such a device using a relatively simple approach: the simple shadow mask etching and deposition technique was used. Although improvements and more explorations are still needed, the obtained high density device working on the principles of electrostatics and mechanics was showed to be a prototype of a device that could be used in the future.

2: Obtaining Oxalic Acid from Wood

Not all the remains are used after cutting down forest. Timber is used whereas branches, bushes and smaller trees are left behind in the clearing or they are burnt. It is waste and it negatively affects the environment. Living in an area rich in forests and having come into contact with the wood industry, Aleksandrs wondered why small and not so valuable trees are not made use of. Considering the economic usage of wood pulp resources, he tried to find a possibility to use these trees. As one of the possibilities, he foresees the use of not so valuable wood pulp in the chemical industry. The results from practical experiments proved that it is possible to obtain even higher amounts of chemical substances (particularly oxalic acid) from less valuable trees than from economically high quality tree species.

3: Pentominoes' Twins

From ancient times people have enjoyed solving logic puzzles, playing mathematical games – definitely it is a perfect way of spending one's leisure time and developing one's thinking. Inga and Madars decided to make their own unique mathematical game which can be solved only in one way. The aim of the game is to cover the chess board 8x8 with all 12 pentominoes making 2 equal figures – pentominoes' twins. Just to find boards being covered in only one way, the algorithms were created and implemented into computer programs. And so the research work which has lasted for 2 years resulted in 549 boards which have only one unique solution.

Lithuania

1: Investigation on the Impact of Housekeeping Detergents upon the Water Ecosystem and their Biological Degradation

or *“What do we pour in our sinks?”*

Abundant and various detergents are used in housekeeping for many years. We decided to investigate the impact of most popular detergents upon the fresh water ecosystem. During the work consumers' behaviour was traversed and the most popular brands of detergents were determined. Also it was found what types of detergents influence fresh water. Because the methods for detection of biological degradation of detergents take much time, a much simpler device has been developed.

2: Students' Activity in Science Events

It is vital to shape a knowledge society of full value. Its core should be highly educated and able to actively use their knowledge. These features should be nurtured at school, but also various science contests contribute to acquiring knowledge, therefore it is extremely important to stimulate the students' activity in such events and to establish appropriate conditions. The aim of this research is to define students of 9-12 grades activity in various science events; to ascertain the reasons of their participation; to propose how to raise students' participation in science events.

3: “Real Estate Business Simulator”

In this project an innovative 3D computer game is presented. The basic idea behind it is to create a game, which increases your logical intellectual, management and financial skills and let people gain practice in real estate business. There are many strategies and tactics to play this game. Some factors in the “Real Estate Business Simulator” oblige the player to think about his next actions and players manage their real estate like real businessman.

Luxembourg

1: Analysis of the arrival and departure dates of the local breeding birds: the Reed and Marsh Warbler

Reed and the Marsh Warbler, *Acrocephalus scirpaceus* and *A. palustris*, are mainly living in wet environments and surroundings. One is migrating by the western migration route, passing Gibraltar, Morocco and to sub-Saharan West of Africa; the other flies over the Bosphorus and the Nile valley to south-East Africa. Analyzing the migration habits of both species, I saw that the number of Marsh Warbler breeding couples exceeded those ones of the Reed Warbler, so I proved that the Marsh arrive later than the Reed. All the results prove that the arrivals and departures of the Reed Warbler are less concentrated than it is for the Marsh. So the migration route is not the only reason for leaving, but competition provoked by other birds is a major role in order to survive. Because these circumstances are the same for both species, the migration phenology is the most influencing factor of arrival and departure dates of the local breeding birds.

Malta

1: Quarry Rehabilitation, Waste Management & Sustainable Agricultural Development

The objective of this project was to find a social, environmental and economic sustainable remedy for the visual pollution of quarrying by building an agricultural village, using inert construction and demolition waste which totally matches with the surrounding Mediterranean topography, without causing further pollution to the nearby habitat. This has been done by the creation of effective water and mineral cycles, ecosystem dynamics and sustainable energy flow. Such a scheme is promoted as it involves environmentally friendly methods of energy stimulation and conservation. In the long-run such a project is considered to be cost-effective economically, socially and environmentally.

Norway

1: Effect of underwater barrier on speeds of Tsunami wave.

On December 26, 2004, an earthquake with magnitude 9.15 Richter, occurred in the Indian Ocean. The immensely strong earthquake resulted in a Tsunami which struck most of the countries surrounding the Indian Ocean, and killed over 200 000 people. In this projects the wave speed and the wave particle speed of tsunami wave was investigated. In addition the effect of a barrier on the speeds was studied experimentally.

A number of experiments were performed in a water tank, and the behaviour of a generated tsunami wave was observed as the wave moved from the deep part of the tank to the shore, both with and without the presence of the barrier. The experimental results showed that it is the wave particle speed that governs the destruction strength of a tsunami wave.

Therefore, building a barrier is a potentially good solution for decreasing the fatal power of a tsunami.

2: Trading Principles: How and why did the Norwegian Labour Party shift its views on Leon Trotsky during his exile in Norway: June 1935 - December 1936?

This project looks into the Russian revolutionary Leon Trotsky's exile in Norway from June 1935 - December 1936 and tries to determine how and why the Norwegian Labour Party decided to expel him. Finding objective secondary sources concerning Leon Trotsky's exile is difficult as they are extensively coloured by the historians' views and attitudes. Therefore, to try to establish the Labour Party's shifting views, primary sources have been examined: newspaper articles, Government protocols and books. The project uses extensive research of these primary sources, such as newspaper articles, government protocols and books, to try to present an objective view of which factors were dominant in the Labour Party's decision.

Poland

1: Geometric transformation relating the Euler and Nagel lines

Triangle geometry is the study of the properties of triangles, including associated triangle centres, triangle lines, central circles, triangle cubics, and many others. These geometric objects often have remarkable properties.

In his project Michal has defined a geometrical transformation which, as it turns out, has many interesting properties. He uses this transformation to show direct connections between Euler and Nagel lines of a triangle (those are specific lines on which pass through a lot of

triangle centers). In this way, if we know something about the Euler line, we can often find similar information about the Nagel line. Applying this duality, Michal has found new properties of those lines and has provided easy and natural proofs of some well-known facts.

2: The experimental investigation of the relationship between a position of the rotating mast and main sail's efficiency

Maciek's project concerns rotating droplet masts used mainly on professional yachts designed for the purpose of racing. When the mast has a possibility to rotate it creates together with the sail an aerodynamic profile, which can be changed or adjusted by the sailors. Being a sailor-hobbyist Maciek was interested in the most efficient profile. Using an aerodynamic tunnel of his own design and models of masts with a sail he tried to draw practical conclusions and answer the crucial question: how to use a very expensive rotating mast efficiently.

3: Synthesis of new potential β -blockers

Heart diseases are the most dangerous killers of humans. One of the methods of neutralizing these diseases is to treat them with drugs from the family of β -blockers, the examples of which are propranolol and metoprolol.

In his project Tomek carried out a complex organic chemistry synthesis of a new compound that would probably extend the family of β -blockers with a new efficient drug. Tomek explains how the known β -blockers act and describes the biochemical principles of their action. He presents the process of designing his synthesis and its individual steps.

Portugal

1: The decline of cork tree and holm oak stands

The cork trees and holm oak stands are fundamental to our country. They are important at all levels: ecological, economical, as landscape, as culture. These trees, however, are in great danger, due to a disease called decline, upon which there aren't two similar opinions. There is a chance that a pathogen fungus (*Phytophthora cinnamomi*) be the cause for this disease. We've tested that hypothesis in a set of lab tests. We've tried different treatments for decline, by means of field and lab essays.

2: Toxic effects induced by the Mn^{2+} in *Allium cepa* L.

In spite of the rural characteristics of the region where Arouca is included (North of Portugal), the Mn^{2+} concentration in underground water is very high, and cannot be used for human consumption.

Fátima, Joana and Pedro, wanting to know more about the effects of prolonged exposition to the Mn^{2+} ion on living beings, built and developed a project using onion seeds and bulbs (*Allium cepa* L.) of a variety (cv. Valenciana) grown in Arouca.

The effects were evaluated concerning root germination, growth, development and morphology, cell division alterations and changes in nucleoli organization.

The results showed the development of genetic alterations identical to the ones that led development of cancer in human beings.

Russia

1: Expert System “Triangles: Equality and Tracing”

The present work deals with the creation of the expert system “Triangles: equality and tracing” which is able to help students and their teachers when: a) they prove the equality of triangles which have a non-standard list of equal elements; b) they trace a triangle in non-standard situations or reconstruct a triangle using 3 explicit points on a plane. The structure of the expert system consists of separate parts so its users are able to find requisite information quickly and easily. The accessible material varies in reference material details and is oriented at users with different levels of knowledge. The working example of the expert system “Triangles: equality and tracing” is realized as a computer program and includes 27 new attributes of triangles equality and 7 new algorithms of triangles tracing.

2: Laser-optical measurement of various displacements

The objective of the research was to create a prototype of a laser optical electronic system for measuring angular and translational displacements of a plane, develop the measurement algorithm, implement this algorithm in a computer program, and calculate the measurement errors. The prototype consists of a CCD matrix camera, two laser units with optical extensions which allow producing a straight line or a circle on a flat screen, an instrument for setting the image parameters, a personal computer and devices for independent measurements of angular and translational displacements of the image plane. The researchers proved experimentally the feasibility of the prototype; they also demonstrated adequate performance of the software and evaluated the measurement error.

3: The analysis of maturation of ribosomal pre-RNA in mitochondria of *Leptomonas seymouri*

Representatives of the Trypanosomatidae family are parasites of humans and animals. Maturation of mitochondrial ribosomal RNA of such organisms is an important issue. Currently there is no information about the signals of this RNA incision, yet there is some data about two enzymes, which may take part in this process. Research work on the given problem can make functioning of mitochondria of these organisms more distinct. It will make clear the biochemical process in general and can be useful in developing the means against these parasites.

Slovakia

1: Projection of welding in learning process

The main aim of our project was to obtain a new, helpful learning tool. We are interested in welding processes so we decided to make it more understandable for students. When a lector is learning ways of welding he has to cope with problems such as: not enough room for all of the students to have a direct view to welding process. We made a box which can easily project the process of welding to the projection screen. Therefore all students can see how the lector welded joints, does the deflection angle of electrode, bugs....

We successfully made a new device and a method of its projection to the projection screen.

2: Syntactic parser of English sentences – proof-of-concept

This project is about the formation of the reverse grammar of English language. The result is a simple test computer program, which takes into parts the sentences. This project is still in the stage of development. But the already existing results have a broad range of application. They can be used in applications such as controlling machines and devices by using the voice, or for automatic analysis of electronic mail.

3: The FTDGX2 robot

The FTDGX2 robot is a mobile CNC drilling and milling machine. It can be controlled either manually, by PC or be autonomous. The user can connect onto the robot via BlueTooth. A drill/mill and a pen are mounted onto the robot. Our product contains a complete suite of software for CNC drilling, drawing and controlling misc. functions of the robot. The robot uses advanced technologies, has a task manager and is quite intelligent. The robot could be used as a CNC drilling and milling machine or as a demonstrational tool.

Spain

1: From 606 to PCR (Paul Ehrlich's legacy. From salvarsan to antibiotics)

The objectives of the present work have been: (i) to show the existence of strategies of intermicrobial competition based on the production of antibiotic substances; (ii) to isolate and cultivate the bacteria producing these substances from ground samples; (iii) to demonstrate the efficiency of these substances in cultures of pathogenic microbes; (iv) to group the isolated bacterial strains based on phenotypic criteria; and, (v) to identify these bacterial strains on the basis of their DNA sequences. One of the bacterial strains isolated from the ground samples, belonging to the *Serratia ficaria* species, has shown a great antibiotic effect. We consider that studying its biotechnological use as an antimicrobial drug-producing bacterium would be of high interest, since it has been shown to be more effective against *Escherichia coli* and *Staphylococcus aureus* than classical antibiotics like penicillin.

2: Unusual Oil Hideout. Bottom tar in the Mediterranean Sea. Oil in the foraminifera

30% of the total petroleum is transported at the Mediterranean Sea. This fact made that, every year, 600.000 Tm of oil are dumped into this sea. We obtained 49 samples of marine sediments in the Catalonia's coast (N.E of Spain) and we discovered the existence of a fine layer of micro tar particles at the bottom of the Mediterranean Sea, as deep down as 380 m. These micro tar particles are the result of continuous pollution, maybe from ships. Small protozoa – Foraminifera – accumulate this tar in its shell, which keeps it solid. As the contaminated Foraminifera eventually die, its shell dilutes in the sea, and consequently, only grains of tar remain as a tar mould of the foraminifera shell shape. The oil's life in sea is about 5 years, but this investigation proves that pollution does not disappear and returns to us as a dangerous boomerang.

3: Spectrometry by webcam.

This project consists in the construction of a digital spectrophotometer from a low-priced web cam. Our main objective is to prove the conveniences that the modern computer methods used to analyse the various physical properties of matter and how we can achieve this with low

priced material. The project consists in the construction of a spectrometer, and the development of a computer program, written in the programming language Visual Basic. With this program we are able to obtain the intensity of the light from the images captured by the web cam.

Sweden

1: The Golden Ratio in nature

Is nature arranged with the Golden Ratio as a model? Do shapes with that proportion appeal to people? We have made a three part study with the intention of answering these questions. Some hypotheses about where you can find the Golden Ratio are far-fetched; they often seem to be a result of human attempts to find simple relations in our complex nature. In our study we have not found examples of the Golden Ratio to a great extent neither among people or animals nor among plants. In the study of people's attraction to "the Golden Ratio-shapes" we noticed that symmetry seemed to be more appealing than the Golden Ratio itself.

2: The Night Float

Most fishermen have had the experience of being unable to continue fishing because of the arrival of darkness. The intention of this project was to develop a float that can be used at night. The idea was that by using different light signals the float is able to indicate its position on the surface and also indicate when you have a good catch.

This project shows that it is possible to create a float that reacts to bites and interacts with the fisherman through light signals. It is also fun to show how something as hi-tech as computer technology can be united with fishing giving great benefits to fishermen in the night.

3: Attempts to synthesize a lactam from the marinesponge *Halichondria melanodocia*

From the marine sponge *Halichondria melanodocia* two lactams were isolated in the year 1979. The structure of these two lactams has yet not been verified through synthesis in a laboratory environment neither has the properties of these chemical compounds been studied before. To be able to synthesize the structures in the lab, one has to develop a synthesis plan to predict the different chemical reactions and that is done by different procedures and by using several analysis techniques and database instruments such as Nuclear Magnetic Resonance machine (NMR). I have worked on a synthesis plan, changed it to the specific environments suited for the reaction to be completed, developed synthetic material and tried to manufacture the molecule through synthesis.

Switzerland

1: Computation of Rigid Body Dynamics

Simulation of multi body dynamics has gained in importance in the last decades. There are applications in the film industry for special effects or in product development as a replacement for expensive experiments.

In this study, methods for doing such simulations are introduced. Aim of this project was furthermore to implement simulation software which puts these methods into practice and thus helps detecting difficulties which arise from these methods.

2: Huddle - the Autonomous Compaction Robot

Huddle is a compaction robot that can traverse a rectangle that has been pre-defined for it, without external assistance. It can be used in a toxic environment, so there would no longer be any need for a person to remain on the machine. At the heart of the compaction robot is a PC software package which carries out all the calculations and then sends appropriate commands to three micro-controllers which execute the actions on the machine (such as steering or starting the engine). Navigation is handled by a DGPS receiver which supplies two positions per second (2Hz). For safety reasons, two laser scanners are positioned on the machine for continuous monitoring of the area surrounding the machine.

3: From Book to Text File; Realisation of a Book Scanner, and Programming of an OCR software

The basic idea of this project is the transfer of a complete book to a computer. The entire transfer process shall be carried out without human intervention; i.e., the turning of the individual pages of a book, and the scanning of the pages, shall be performed automatically. Another part of the project is the programming of OCR software, which is able to filter the text from the scanned images.

Turkey

1: Gaussian Integers

In this project, we have focused on Diophantine Equations by using Gaussian Integers. Gaussian Integers are a special type of complex numbers. If a complex number is real and imaginary parts are integer, then it is a Gaussian Integer. By using Gaussian Integers, we can factorize Diophantine Equations into factors which can not be done in integers. By doing this, we switch to Gaussian Integers World. Equating imaginary and real parts in the last equation, we will reach the integer solutions. We also have the solutions of the equation $(x,y)=1$, $x^2+y^2=z^3$ and the equations that can be reduced into this. In this way, we focused on the equations $(x,y)=1$, $x^2+y^2=z^n$. General solutions that we obtained can be used in solving science olympiads problems.

2: Antimask

The objective of this project is the production of an antibacterial mask by utilizing the inhibitory effects of AgNO_3 and TiO_2 . Because the most effective experimental results were derived from $\text{AgNO}_3 + (\text{UV}/\text{TiO}_2)$, this complex was used for covering the mask. There was no colony formation in the samples we took from the covered mask (antimask) although there were many colonies of E. coli in the Müller Hinton Agar samples taken from the uncovered mask. So, using the antimask procedure will be more effective in preventing epidemic and pandemic respiratory diseases.

3: Electromechanics convertor that converts digital text files into Braille alphabet

The project converts digital text files into “Braille” alphabet and helps usually handicapped people read the texts on the computer and use the computers. With a control program which is coded in Visual Basic 6.0 the data which is sent to a parallel port with a control program which is coded in Visual Basic 6.0 is converted into Braille Alphabet with the help of a

specially designed diagram. The project will enable handicapped people to read the text on the computer.

UK

1: Visualising the Future

The problem this project focuses on is: “How effective are the implementations of Dihedral / Anhedral forms of Wing Morphing on Delta Wings specific to Micro-Air-Vehicles (MAV)?” Challenges included the construction of an adjustable delta wing (covered by florescent tufts for visualisation), set-up and wind-tunnel recording. The bulk of the results were obtained through analysing reattachment ratios of vortices; this showed remarkably how increased camber in wing format delayed stall angles, however became more unstable at extreme angles of attack.

2: Analysis of the water-soluble constituents of the herbal product guacatonga

Most oral herbal medicines are prepared traditionally in water. However, normal laboratory methods to determine the active components of herbals utilise non-polar solvents. Consequently the active components of most herbal medicines are not yet determined. This project involved analysis of the water-soluble components of the herbal product Guacatonga (*Casearia sylvestris*) and successfully identified 10 new low molecular weight compounds not previously detected in this plant; one of them is a potent immune modulator.

3: A Study into the Possibility of Bacterial Cross Contamination in Food and Drink Distribution

The aim of this project was to investigate the possibility of bacterial cross contamination in food and drink distribution on hospital wards (based in Kent and Sussex Hospital). Experimental microbiological work was carried out, focusing on pathogenic bacteria (*Staphylococcus aureus*, Vancomycin-resistant Enterococci and *Escherichia Coli*). Further investigation into Sellotape and string as sources of bacterial colonisation and the effectiveness of alcohol gel, became necessary. Changes to hospital procedures were recommended and the response was positive.

Ukraine

1: Progesterone receptors and estrogen receptors retrospective expose in the human ovarian tumor preparations

Ovarian cancer (OC) is known as the most invasive tumour of woman reproductive system. Hormone receptors content in OC reflects sensitivity of tumour to hormone therapy. The goal of this study was to investigate immunohistochemically estrogenic receptors (ER) and progesterone receptors (PR) and to estimate their prognostic value in tumours from patients with OC. Archive materials (samples of tumour tissue were included to paraffin blocks) from patients with OC were used. High expression of PR together with low expression of ER in the tumour support OC patient survival. It is therefore possible to think that survival rate of OC patients is linked to the expression level of steroid hormones in tumours.

USA

1: The Effects of CNS Stimulants and SSRIs on the Formation of Conditioned Long Term Memory and Learning Behaviors in Sleep Deprived Wildtype Drosophila Melanogaster

This project is based on the statement that 63% of the college students suffer from a lack of sleep. 15% are clinically depressed and nearly half of these students take antidepressants. Walker suggests that adequate sleep is crucial for effective learning and long term memory (LTM). Therefore the purpose of this experiment was to document the effects of sleep deprivation on LTM in wild type Drosophila and establish the effects of caffeine and fluoxetine on LTM formation. This study hypothesized that fully rested drosophila would perform better on LTM testing than sleep deprived ones. Additionally, it states that supplementation of fluoxetine and caffeine would foster LTM formation.