EDUTRONICS

Educational Electronics System

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Abstract

In this paper work, we’ll be introducing Edutronics project, as a new creative solution to raise a whole new generation of kids and adolescents, who are be able to lead an industrial and technical revolution for our country, by mastering the field of electronics.

Moreover, we’ll discuss the problems of education in Egypt, some purposed solutions to these problems, also we’ll review all learning styles and stages which have guided us to prepare an educational plan for whoever will be using this project.

This document contains full details about how the hardware and software of this project have developed from scratch till they came to life, as a reliable prototype that proves our concept, and finally our future plans to improve its efficiency, and ensure that we provide a simple, safe and fun learning environment to our users.
ACKNOWLEDGEMENT

Praise Allah for his blessings which without, we wouldn't have been able to complete and finalize this project.

We would like to express our deepest appreciation for our dear professors who have the attitude and the substance of genius; where they have done their best and gave us from their time, knowledge and experience to begin, sustain and finalize our work with this project and make it to come to life.

Special thanks to Professor Dario Assante “Assistant Professor – Uninettuno University” who despite the large distance that separated us, provided us with some really genius and useful ideas for our project, and always kept asking about our progress; we were completely sure that if we needed anything he would have provided as much help as he could. We hope that we’ve lived up to his expectations.

Special thanks to Professor Alaa Hamdy “Assistant Professor – Helwan University” who has helped us with all the available tools and resources to achieve the desired software output and to match the IEEE's International Standards for software mobile applications.

Special thanks to Professor Amr Elsayyed “Lecturer – Helwan University” who was very supportive to the project’s idea, endorsed us to work as a team, and helped us finalize the Hardware Educational Kits and ensured it matched the IEEE's Standards for the Electronics Education.

We would like to thank our families; Mothers, fathers, brothers and sisters who have helped us with all they could do by assisting us mentally, financially where they haven’t slept the nights just to serve us in our gatherings and give us a great motivation.

We would like to thank our friends who have helped us with all their possibilities to search, buy the components needed and to make a full problem research on our society.

In addition we would like also to thank our dean and our department's management for their cooperation giving us all the facilities available from our faculty and the Egyptian government.
Chapter One: Introduction
1.1-Problem review:

The 118th out of 148 countries; again, Egypt retreats from the 107th out of 144 place in 2012-2013 to the 118th in 2013-2014 Global Competitiveness Index (GCI), issued by the World Economic Forum (WEF), keeping our country at the bottom of the report.

Lately there have been too many problems in Egypt, where we can say that most of them - if not all - are dependent on each other's such as poverty, health, traffic congestion and high population, lack of the Industrial levels, Education...etc.

As an example the health problems is dependent on poverty and education, traffic congestions is dependent on high population and education, the lack of the industrial level is dependent on the high salaries of the Egyptian market and the low quality obtained from the Egyptian technicians which is also dependent on the low quality of Education.

If we had a keen overview for these problems we would Figure out that the most common problem resulting in other problems is the problem of the bad education.

Since the world's most common trend nowadays is about the new technologies and the electronic industries, a country with a bad education would hardly compete leading to another huge economic problem for this country.

Likewise most of the problems in Egypt is because of the bad education quality thus the absence of technical education; an electrical or an embedded systems Engineering student would know nothing about what he will be doing after he gets graduated before entering the faculty.

The duration of this Educational stage is so small for a student to cover the least information for having the bachelor’s degree, or to have the job title of an Engineer or either a technician.

From the research made by the International Institute of Technology, the main reasons for keeping a country away from producing electronic devices or electronic components would be one of two different orientation reasons:

1. Business Oriented reasons (BOR)
2. Technical Oriented reasons (TOR)

If we came to the point of the TOR we would find that the main reason in the TOR is the lack of information and education of the Egyptians specially in the major of electronic production which had a great Impact in the Global Competitiveness Index included (GCI) in the Global Competitiveness Report by World Economic Forum taking Egypt from coming 89th country in the index in the close past to be the to be the 118th over 148 country in 2013-2014's Report.

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1 The Global Competitiveness Report 2013 - 2014
1.1.2-What’s Global Competitive Index (GCI)?

2 It’s a report that assesses the ability of countries to provide high levels of prosperity to their citizens. This in turn depends on how productively a country uses available resources. Therefore, the Global Competitiveness Index measures the set of institutions, policies, and factors that set the sustainable current and medium-term levels of economic prosperity.

1.1.3-Egypt in the GCI regarding the main problem:

3 In the latest GCR (2013-2014) Egypt ranking was to be the last in the quality of primary education according to the latest Global Competitiveness Report issued by World Economic Forum. Shocked Arabic and English newspaper commentators drew particular attention to the embarrassingly low score on education, while online social network users wondered whether this Figure is really true and Egypt did really rank the lowest among countries listed in this report.

While recognizing the significance of the Figures cited and admitting that public education in Egypt is in a dismal state, it is problematic to be citing the Global Competitiveness Report on this matter, for a very simple reason:

There are two Figures in the report that cover primary education in Egypt. One is the net enrollment rate, which means the percentage of children from a given age group enrolled in the academic year for that age group. So if we assume that 5th grade is for ten year-olds, then the net enrollment rate for 5th grade would be the number of ten year-old children enrolled divided by the number of ten year-olds in the country. It is the first, most basic indicator people use to get a sense of how big the education system is and how many kids are enrolled in schools. Access to education is by no means an indicator of the level of quality. Egypt has famously done fairly well on enrollment rates while doing very poorly on other quality indicators.

So Egypt’s net enrollment rate for primary education is listed in the report as being 95.6%, with a ranking of 58/148. Generally not bad but also not good either. 95.6% sounds nice and high but it's important here to remember two things:

1. It is an average rate and the rates for girls and for children in rural, remote and economically marginalized areas are lower than the average.
2. It is just an indicator of how many kids are going to school and mentions nothing about what type of education these children receive there.

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2 Wikipedia
3 The Global Competitiveness Report 2013 - 2014
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**Table 1.1.3.1: Egypt and the net enrollment rate**
The second Figure related to primary education, and the one that has everyone up in arms is listed as "Quality of Primary Education" and Figure 1.1.3.2 given in, which ranks Egypt at 148 out of the 148 countries covered in the report. According to the report itself, this Figure is the average score given by respondents to a question on the Executive Opinion Survey. The survey provides the bulk of the data the report is based on. The respondents of this survey, and here is the important part, are people from various sectors within the business community. For this year’s report, the survey in Egypt (conducted by the Egyptian Center for Economic Studies) collected responses from 71 business people. The question they were asked about primary education was “How would you assess the quality of primary schools in your country?” (Or most likely something very close to it, as this was the question used for the same item in the 2009 survey and I doubt much has changed). Respondents were to give their answer as a rank, ranging from 1, indicating “Poor” to 7 indicating “Excellent—among the best in the world”. So the average rank for the quality of primary education, from 71 executives from various sectors and business sizes, was 2/7. This was the lowest rank among all the countries.

-Table 1.1.3.2: Egypt and Primary education-
1.2.1-Proposed Solutions:

From the previous information, it all lies in increasing the country’s production and industrial activities, and this will happen through:

1. The government creates a favorable framework for businesses activities.
2. Assisting the promotion of the diffusion of new technologies. Ultimately, it is new technologies that improve productivity.
3. Facilitating the inventions’ patent process, as it takes years to be completed.
4. Facilitating the movement of the workforce from low to high productivity activities, both on an inter-regional and inter-industry basis.
5. Investment in post-secondary education, both in terms of the teaching and, of course, research and development.
6. Realizing the importance of research field, and encourage promising research institutes through awareness.
7. Converting researches from ideas to the real world and getting use of them in facing Egypt’s problems.
8. Increasing the awareness of the importance of the technical education.
9. Using different approaches and learning from other cultures how they benefit from them and applying them in our educational systems.
10. The government should increase the budget of education and it should spend bigger percentage on the infrastructure.
11. Increasing the attention of the rural areas and building larger number of school according to the international standards.
12. Spending much money on advanced learning equipment.
13. Encouraging private companies and foundations to help Figurehting illiteracy.
14. Performing national projects to develop the education in Egypt.
1.2.2-Our solution:

Being engineers, we have a very effective role in developing this community and providing it with the tools, products and technologies that revive its economy.

Basically we provide a learning system that relates to the quote “Give a man a fish and he’ll eat for a day, teach a man how to fish and he’ll eat for a lifetime” I want you to imagine, a whole new generation that’s been learning electronics and implementing circuits since the age of 8, what would they capable to achieve?

We aim to prepare a generation that will lead a technological revolution for our country, through manufacturing educational kits and components that aim to develop the technical skills of our future generation in a safe, simple and fun learning environment based on learning by doing, which will be one of the main methods to place Egypt among the top countries in the Global Competitiveness Index on the long run.

Our main user is the child that we’ll reach through his/her parent, who’ll be an easy target once he/she knows the use of our product, by simply clarifying the function and operation of our project; Who won’t like the idea of making his kid play with something that will literally enhance his brain skills?

The children’s’ curiosity will be a great help, every child would wish to make his own game, imagine how will he/she react when he hears that he can make a circuit that performs a certain function, remember how your own kids or siblings reacted when they connected a lamp with a battery in school and it lit or when they created a magnetic field with a nail, they sure were interested; learning by doing, that’s the best and the most interesting learning method.
Chapter two: Project Educational System
Chapter 2

2.1-General Education problems in Egypt:

We’ll sum up all the problems in the upcoming points:

1. No clear governmental plans
   - Instability, and no binding rules to maintain assurance in the schooling or the academic university systems.
   - No long term plans for reforming education.
   - Almost every year there is a new decision taken by a new prime minister or a minister concerning a new law that affects education.
   - Every new minister of education comes and ignores the previous minister’s efforts and start again.

2. Over population
   - Statistics from Central Agency for Public Mobilization and Statistics shows that there are 16 million 101 thousand and 210 student in Egypt.
   - Classes are so crowded so teachers can’t give all what they have.
   - No appropriate environment for education.
   - Less attention to the instructor.
   - Students can’t use the education facilities like labs due to their number.
   - Faster destruction for the infrastructure like classes, bathrooms, labs.
   - Health problems may happen because of the crowd.

3. Unqualified instructors
   - As a result of bad education systems there are many teachers who aren't well qualified to deal with the students.
   - The inefficiency of the instructors and his inability to convey the information properly and also the inability to distinguish the differences between individual students.
   - In each level of education student needs a specific kind of treatment from teachers but they don’t understand this.
   - Instructors lack how to deal with students psychologically and lack to having different ways of teaching.

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4 Presentation about problems of education by Nile University 2013
4. **Illiteracy**
   - Large number of illiterates in Egypt.
   - There is a relation between poverty and illiteracy in Egypt.
   - 45% of the workers in Egypt are illiterates.
   - The Egyptian government doesn’t spend enough money in fighting illiteracy.

   ![Estimated world illiteracy rates, by region and by gender, 2000](image)

   *Source: UNESCO Institute for Statistics
   *Not including Japan, Australia and New Zealand

5. **Private lessons**
   - Students are less interested in going to schools.
   - Changing the nature of the relation between the student and the teacher.
   - Creating type of dependency at the student.
   - Teachers are not giving the required care to the students in schools.
   - Teachers distinguish between students in treatment in classes.
   - Private lessons creates miserable economic burden on families.

6. **Old techniques of education**
   - The educational system didn’t change since Mohamed Ali.
   - The cramming system where the teacher provides everything, and students take notes, there is no participation.
   - Moreover, each lesson has an enormous amount of data that has to be memorized by heart to be able to pass their finals at the end of the term.
• The grading scheme is unfair because the whole grade depends only on the finals so we find the phenomenon of students studying at home and they don’t go to schools.

7. The gap between the family and the school
   • The family and the school are the main factors in building the student's background and habits.
   • These two factors must work together in the right way to improve the student's performance and to solve the problems that the student might face.
   • The absence of any factor of them leads to:
     • Bad habits like drugs, Alcohol, disrespecting.
     • Poor academic performance.
     • Bad behavior regards teachers.

8. Infrastructure
   • The educational infrastructure in Egypt isn’t strong or developed at all.
   • The number of schools isn’t proportional to the number of students especially in the countryside.
   • Many children have to walk for kilometers to reach their schools.
   • Schools don’t contain advanced labs and modern technology means.

9. Neglecting Technical Education, which is the main problem that we’re concerned about as it’s related to our field as engineers; caused by the following:
   • Reasons:
     i. The society’s view of technical education is always negative.
     ii. The poor condition of buildings and equipment of the schools because the government doesn’t develop them.
     iii. The number of students in classes is huge so classes are overcrowded.
     iv. Concentrating on the theoretical side and ignoring the practical one.
   • Which led to:
     i. Students don’t have enough abilities.
     ii. Graduates don’t find work which increases the problem of unemployment

10. Subjects aren’t related to the labor market
2.2-Proposed Solutions:

1. Technical Education
   - Increasing the awareness of the importance of the technical education to change the people’s look to it by making campaigns in the media.
   - Developing the equipment and the constructions and coping with the modern techniques.
   - Taking the students to attend international conferences to recognize what the world reached.
   - Finding jobs for graduates with good salaries.
   - Making final projects like engineering faculties.

2. Old techniques of education
   - Provide students with creative, fun, syllabuses to ensure that they learn while having fun.
   - Using different approaches and learning from other cultures how they benefit from them and applying them in our educational systems.
   - Project based learning.
   - Task based learning.
   - Language communicative skills.

3. Infrastructure
   - The budget of education in Egypt in 2011 is 36.3 Billion LE. Which represents 3.4% from Egypt’s budget.
   - Statistics show that 94% from the education budget goes for salaries.
   - The government should increase the budget of education and it should spend bigger percentage on the infrastructure.
   - Increasing the attention of the rural areas and building larger number of schools according to the international standards.
   - Spending much money on advanced equipment like labs and computer.
   - Maintenance is the most important thing to save the money spent.

4. Performing national projects to develop the education in Egypt like Zewail’s city for sciences and technology.

5. Increasing the attention of scientific research which is really ignored in Egypt and increasing its budget.

6. Converting researches from ideas to the real world and getting use of them in facing Egypt’s problems

7. Overcome the problem if bureaucracy that faces any ambitious project in Egypt.
2.3-Different learning styles:

2.3.1-Overview of learning styles:

Many people recognize that each person prefers different learning styles and techniques. Learning styles group common ways that people learn. Everyone has a mix of learning styles. Some people may find that they have a dominant style of learning, with far less use of the other styles. Others may find that they use different styles in different circumstances. There is no right mix. Nor are your styles fixed. You can develop ability in less dominant styles, as well as further develop styles that you already use well.

Using multiple learning styles and multiple intelligences for learning is a relatively new approach. This approach is one that educators have only recently started to recognize. Traditional schooling used (and continues to use) mainly linguistic and logical teaching methods. It also uses a limited range of learning and teaching techniques. Many schools still rely on classroom and book-based teaching, much repetition, and pressured exams for reinforcement and review. A result is that we often label those who use these learning styles and techniques as bright. Those who use less favored learning styles often find themselves in lower classes, with various not-so-complimentary labels and sometimes lower quality teaching. This can create positive and negative spirals that reinforce the belief that one is "smart" or "dumb".

By recognizing and understanding your own learning styles, you can use techniques better suited to you. This improves the speed and quality of your learning.

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5 learning-styles-online.com
2.3.2-Understanding the basis of learning styles:

Learning styles have more influence than you may realize. Your preferred styles guide the way you learn. They also change the way you internally represent experiences, the way you recall information, and even the words you choose. We explore more of these features in this chapter.

Research shows us that each learning style uses different parts of the brain. By involving more of the brain during learning, we remember more of what we learn. Researchers using brain-imaging technologies have been able to find out the key areas of the brain responsible for each learning style.

For example:

- **Visual**: The occipital lobes at the back of the brain manage the visual sense. Both the occipital and parietal lobes manage spatial orientation.
- **Aural**: The temporal lobes handle aural content. The right temporal lobe is especially important for music.
- **Verbal**: The temporal and frontal lobes, especially two specialized areas called Broca’s and Wernicke’s areas (in the left hemisphere of these two lobes).
- **Physical**: The cerebellum and the motor cortex (at the back of the frontal lobe) handle much of our physical movement.
- **Logical**: The parietal lobes, especially the left side, drive our logical thinking.
- **Social**: The frontal and temporal lobes handle much of our social activities. The limbic system (not shown apart from the hippocampus) also influences both the social and solitary styles. The limbic system has a lot to do with emotions, moods and aggression.
- **Solitary**: The frontal and parietal lobes, and the limbic system, are also active with this style.
2.3.2.1-Visual (Spatial) learning style:

If you use the visual style, you prefer using images, pictures, colors, and maps to organize information and communicate with others. You can easily visualize objects, plans and outcomes in your mind's eye. You also have a good spatial sense, which gives you a good sense of direction. You can easily find your way around using maps, and you rarely get lost. When you walk out of an elevator, you instinctively know which way to turn.

The whiteboard is a best friend (or would be if you had access to one). You love drawing, scribbling and doodling, especially with colors. You typically have a good dress sense and color balance (although not always!).

Common pursuits and phrases

Some pursuits that make the most use of the visual style are visual art, architecture, photography, video or film, design, planning (especially strategic), and navigation.

You may tend to use phrases like these:

- Let's look at it differently.
- See how this works for you.
- I can't quite picture it.
- Let's draw a diagram or map.
- I'd like to get a different perspective.
- I never forget a face.
Learning and techniques:

If you are a visual learner, use images, pictures, color and other visual media to help you learn. Incorporate much imagery into your visualizations.

You may find that visualization comes easily to you. This also means that you may have to make your visualizations stand out more. This makes sure new material is obvious among all the other visual images you have floating around inside your head.

- Use color, layout, and spatial organization in your associations, and use many 'visual words' in your assertions. Examples include see, picture, perspective, visual, and map.
- Use mind maps. Use color and pictures in place of text, wherever possible. If you don't use the computer, make sure you have at least four different color pens.
- Systems diagrams can help you visualize the links between parts of a system, for example major engine parts or the principle of sailing in equilibrium. Replace words with pictures, and use color to highlight major and minor links.
- The visual journey or story technique helps you memorize content that isn't easy to 'see.' The visual story approach for memorizing procedures is a good example of this.
- Peg words and events come easily to you, however you need to spend some time learning at least the first ten peg words. Afterwards, your ability to visualize helps you peg content quickly.
- The swish technique for changing behaviors also works well for you, as it relies on visualization.
2.3.2.2- The Aural (Auditory-Musical-Rhythmic) Learning Style:

If you use the aural style, you like to work with sound and music. You have a good sense of pitch and rhythm. You typically can sing, play a musical instrument, or identify the sounds of different instruments. Certain music invokes strong emotions. You notice the music playing in the background of movies, TV shows and other media. You often find yourself humming or tapping a song or jingle, or a theme or jingle pops into your head without prompting.

Common Pursuits and Phrases

Some pursuits that use the aural style are playing, conducting, or composing music, and sound engineering (mixing and audiovisual work).

You may tend to use phrases like these:

- That sounds about right.
- That rings a bell.
- It's coming through loud and clear.
- Tune in to what I'm saying
- Clear as a bell.
- That's music to my ears.

Learning and Techniques

- If you are an aural learner, use sound, rhyme, and music in your learning. Focus on using aural content in your association and visualization.
- Use sound recordings to provide a background and help you get into visualizations. For example, use a recording of an aircraft engine running normally, playing loudly via a headset, to practice flight procedures. Use a recording of the sound of wind and water when visualizing sailing maneuvers. If you don't have these recordings, consider creating them while next out training.
- When creating mnemonics or acrostics, make the most of rhythm and rhyme, or set them to a jingle or part of a song.
- Use the anchoring technique to recall various states that music invokes in you. If you have some particular music or song that makes you want to 'take on the world,' play it back and anchor your emotions and state. When you need the boost, you can easily recall the state without needing the music.
2.3.2.3- The Verbal (Linguistic) Learning Style:

The verbal style involves both the written and spoken word. If you use this style, you find it easy to express yourself, both in writing and verbally. You love reading and writing. You like playing on the meaning or sound of words, such as in tongue twisters, rhymes, limericks and the like. You know the meaning of many words, and regularly make an effort to find the meaning of new words. You use these words, as well as phrases you have picked up recently, when talking to others.

Common pursuits and phrases

Pursuits that use the verbal style include public speaking, debating, politics, writing and journalism.

You may tend to use phrases like these:

- Tell me word for word
- Let's talk later.
- The word you're looking for is
- I hear you but I'm not sure I agree.
- Let me spell it out for you.
- In other words

Learning and techniques

- If you are a verbal learner, try the techniques that involve speaking and writing. Find ways to incorporate more speaking and writing in techniques. For example, talk yourself through procedures in the simulator, or use recordings of your content for repetition.
- Make the most of the word-based techniques such as assertions and scripting. Use rhyme and rhythm in your assertions where you can, and be sure to read important ones aloud. Set some key points to a familiar song, jingle or theme.
- Mnemonics are your friends for recalling lists of information. Acronym mnemonics use words, focusing on the first letter of the word to make up another word or memorable sequence. You can also make up phrases using the items you want to memorize.
- Scripting is also powerful for you. You don't just have to write them down. Record your scripts using a tape or digital audio recorder (such as an MP3 player), and use it later for reviews.
- When you read content aloud, make it dramatic and varied. Instead of using a monotone voice to go over a procedure, turn it into a lively and energetic speech
worthy of the theatre. Not only does this help your recall, you get to practice your dramatic presence!

- Try working with others and using role-playing to learn verbal exchanges such as negotiations, sales or radio calls.

### 2.3.2.4- The Physical (Bodily-Kinesthetic) Learning Style:

If the physical style is more like you, it's likely that you use your body and sense of touch to learn about the world around you. It's likely you like sports and exercise, and other physical activities such as gardening or woodworking. You like to think out issues, ideas and problems while you exercise. You would rather go for a run or walk if something is bothering you, rather than sitting at home.

You are more sensitive to the physical world around you. You notice and appreciate textures, for example in clothes or furniture. You like 'getting your hands dirty,' or making models, or working out jigsaws.

You typically use larger hand gestures and other body language to communicate. You probably don't mind getting up and dancing either, at least when the time is right. You either love the physical action of theme park rides, or they upset your inner body sense too much and so you avoid them altogether.

When you are learning a new skill or topic, you would prefer to 'jump in' and play with the physical parts as soon as possible. You would prefer to pull an engine apart and put it back together, rather than reading or looking at diagrams about how it works.

The thought of sitting in a lecture listening to someone else talk is repulsive. In those circumstances, you fidget or can't sit still for long. You want to get up and move around.

**Common Pursuits and Phrases**

Pursuits that involve the physical style include general physical work, mechanical, construction and repair work, sports and athletics, drama and dancing.

You may tend to use phrases like these:

- That feels right to me.
- I can't get a grip on this'
- Stay in touch.
- Get in touch with'
- That doesn't sit right with me.
- I have good feelings about this.
My gut is telling me'
I follow your drift.

Learning and techniques

If you use a physical style, use touch, action, movement and hands-on work in your learning activities. For visualization, focus on the sensations you would expect in each scenario. For example, if you are visualizing a tack (turn) on a sailboat, focus on physical sensations. Feel the pressure against your hand as you turn the rudder, and the tension lessening on the ropes. Feel the wind change to the other side, feel the thud as the sail swaps with the wind, and feel the boat speed up as you start the new leg.

For assertions and scripting, describe the physical feelings of your actions. For example, a pilot might script as follows: 'I feel the friction as I push the throttle forward to start my takeoff run. The controls start to feel more responsive as I check the airspeed, oil pressure and temperature. At takeoff speed, I pull back slightly, and I feel the vibrations of the wheels stop as the plane leaves the ground. After a few moments, I reach down and set the gear selector to up. I feel the satisfying bump as the gear stops fully up.'

Use physical objects as much as possible. Physically touch objects as you learn about what they do. Flashcards can help you memorize information because you can touch and move them around.

Keep in mind as well that writing and drawing diagrams are physical activities, so don't neglect these techniques. Perhaps use big sheets of paper and large color markers for your diagrams. You then get more action from the drawing.

Use breathing and relaxation to focus your state while you learn and perform. Focus on staying calm, centered, relaxed and aware. If you want to gain more control over your physical state, look up some references on Autogenics. This was a secret behind the Great Russian athletic performances over the past few decades.

Use role-playing, either singularly or with someone else, to practice skills and behaviors. Find ways to act out or simulate what you are learning.
**2.3.2.5- The Logical (Mathematical) Learning Style:**

If you use the logical style, you like using your brain for logical and mathematical reasoning. You can recognize patterns easily, as well as connections between seemingly meaningless content. This also leads you to classify and group information to help you learn or understand it.

You work well with numbers and you can perform complex calculations. You remember the basics of trigonometry and algebra, and you can do moderately complex calculations in your head.

You typically work through problems and issues in a systematic way, and you like to create procedures for future use. You are happy setting numerical targets and budgets, and you track your progress towards these. You like creating agendas, itineraries, and to-do lists, and you typically number and rank them before putting them into action.

Your scientific approach to thinking means you often support your points with logical examples or statistics. You pick up logic flaws in other peoples words, writing or actions, and you may point these out to people (not always to everyone's amusement).

You like working out strategies and using simulation. You may like games such as brainteasers, backgammon, and chess. You may also like PC games such as Dune II, Starcraft, Age of Empires, Sid Meier games and others.

**Common Pursuits and Phrases**

People with a strong logical style are likely to follow such pursuits as the sciences, mathematics, accounting, detective work, law and computer programming.

You are more likely to use phrases that reflect you’re most dominant style out of the visual, aural or physical styles, however you may also use phrases like these:

- That's logical.
- Follow the process, procedure, or rules.
- There's no pattern to this.
- Let's make a list.
- We can work it out.
- Quantify it, or prove it!
Learning and techniques

- If you are a logical learner, aim to understand the reasons behind your content and skills. Don't just rote learn. Understanding more detail behind your compulsory content helps you memorize and learn the material that you need to know. Explore the links between various systems, and note them down.

- While you study, create and use lists by extracting key points from your material. You may also want to use statistics and other analysis to help you identify areas you may want to concentrate on.

- Pay attention to your physical state, for example you’re breathing and stress level. It's possible that you isolate your own body from your rational thought. Remember that you are just as much a part of the 'system' as any equipment you may be using.

- Also remember that association often works well when it is illogical and irrational. It doesn't matter how logical two items are together. You have a better chance of recalling them later if you have make the association illogical. Your brain may protest at first!

- In your scripting though, highlight logical thoughts and behaviors. Highlight your ability to pick up systems and procedures easily, and that you can detect when you need to change a set procedure.

- Make use of 'systems thinking' to help understand the links between various parts of a system. An important point here is that systems thinking helps you understand the bigger picture. Often the whole is greater than the sum of the parts. For example, you may understand the individual aircraft systems and flight surfaces, but you may not have a view of how all those systems support flight in equilibrium. Systems diagrams can help you gain that understanding.

- You may find it challenging to change existing behaviors or habits. You can rationalize all you want to about why you should change a behavior, but you may find it persists. Try the shunt technique to understand what behavior you currently have and what behavior you want to have. When you understand those behaviors, use the technique to divert from the old behavior to the new.

- You may sometimes overanalyze certain parts of your learning or training. This can lead to analysis paralysis. You may be busy, but not moving towards your goal. If you find you are overanalyzing which school to start with, or you are over-planning your course maps, stop and refocus on activities that move you forward. Consider how much 'bang for buck' you get from spending more time than necessary. Measure your activities by your speed towards your goal. Planning exactly how much time to spend on each chapter of theory doesn't help learn it anywhere near as fast as starting on the theory!
• If you often focus from analysis paralysis, write 'Do It Now' in big letters on some signs or post-it notes. Place them in strategic places around your work or study area.

2.3.2.6- The Social (Interpersonal) Learning Style:

If you have a strong social style, you communicate well with people, both verbally and non-verbally. People listen to you or come to you for advice, and you are sensitive to their motivations, feelings or moods. You listen well and understand other's views. You may enjoy mentoring or counseling others.

You typically prefer learning in groups or classes, or you like to spend much one-on-one time with a teacher or an instructor. You heighten your learning by bouncing your thoughts off other people and listening to how they respond. You prefer to work through issues, ideas and problems with a group. You thoroughly enjoy working with a 'clicking' or synergistic group of people.

You prefer to stay around after class and talk with others. You prefer social activities, rather than doing your own thing. You typically like games that involve other people, such as card games and board games. The same applies to team sports such as football or soccer, basketball, baseball, volleyball, baseball and hockey.

Common pursuits and phrases

Some examples of pursuits that people with a strong social style may follow include counseling, teaching, training and coaching, sales, politics, human resources, and others.

As with people with the logical style, you are more likely to use phrases that reflect your dominant style out of physical, aural and visual styles. Here are some other phrases you may also use:

• Let's work together on this.

• We can work it out.

• Tell me what you are thinking.

• Help me understand this.

• Let's pull some people together to discuss.

• Let's explore our options.
Learning and techniques

- If you are a social learner, aim to work with others as much as possible. Try to study with a class. If this is not available then consider forming your own study group with others at a similar level. They don’t have to be from the same school or class. If you like, introduce them to some of the techniques from this book. It may be easier for you to try some of the Memletric Techniques in a social setting, and work with the feedback from others.

- Role-playing is a technique that works well with others, whether it’s one on one or with a group of people. For example, in aviation training, role-play the aerodrome area. Have people walking around in ‘circuits’ making the right radio calls with the tower coordinating everyone. Another example might be to role-play with one person being the instructor and the other being the student.

- Work on some of your associations and visualizations with other people. Make sure they understand the principles of what you are doing though, otherwise you may get some interesting responses! Others often have different perspectives and creative styles, and so the group may come up with more varied and imaginative associations compared to the ones you might create yourself.

- Rather than reciting assertions to yourself, try sharing your key assertions with others. By doing so, you are almost signing a social contract that your assertion is what you do. This strengthens your assertions.

- Share your reviews, review checklists and 'perfect performance' scripts with those in your group as well. By listening to how others solve their issues, you may get further ideas on how to solve your own issues. Try sharing the work of creating a 'perfect performance' script. Each person writes the script for the areas they want to work on the most, and then the group brings all the scripts together.

- Mind maps and systems diagrams are great to work on in class. Have one person be the appointed drawer, while the rest of the class works through material and suggests ideas. The group may have varied views on how to represent some ideas, however this is a positive part of learning in groups. If you can’t agree on something, just take a copy of what the group has worked on and add your own thoughts. Often there is no right answer for everyone, so agree to disagree!

- Working in groups to practice behaviors or procedures help you understand how to deal with variations. Seeing the mistakes or errors that others make can help you avoid them later. As well, the errors you make are helpful to others! Whether it’s via role-playing, a simulator or other technique doesn’t matter too much. Be imaginative. Two chairs in the middle of a classroom to simulate an aircraft cockpit can be just as good as computer simulation and the real activity.
Lastly, if you are working in groups it may help to have everyone do the learning styles questionnaire. This may help everyone understand why each person has different viewpoints. It can also help with assigning activities to people. Individuals may volunteer for activities based on either the styles they currently have, or the styles they want to learn.

2.3.2.7 - The Solitary (Intrapersonal) Learning Style:

If you have a solitary style, you are more private, introspective and independent. You can concentrate well, focusing your thoughts and feelings on your current topic. You are aware of your own thinking, and you may analyze the different ways you think and feel.

You spend time on self-analysis, and often reflect on past events and the way you approached them. You take time to ponder and assess your own accomplishments or challenges. You may keep a journal, diary or personal log to record your personal thoughts and events.

You like to spend time alone. You may have a personal hobby. You prefer traveling or holidaying in remote or places, away from crowds.

You feel that you know yourself. You think independently, and you know your mind. You may have attended self-development workshops, read self-help books or used other methods to develop a deeper understanding of yourself.

You prefer to work on problems by retreating to somewhere quiet and working through possible solutions. You may sometimes spend too much time trying to solve a problem that you could more easily solve by talking to someone.

You like to make plans and set goals. You know your direction in life and work. You prefer to work for yourself, or have thought a lot about it. If you don't know your current direction in life, you feel a deep sense of dissatisfaction.

Common pursuits and phrases

Those that have a strong solitary style include authors, researchers, park rangers and security guards. Peak performers in any field often have a good solitary style behind other more dominant styles.

You are more likely to use phrases that reflect your other dominant styles. Here are some other phrases you may also use:

- I'd like some time to think it over.
- This is what I think or feel about that.
- I'd like to get away from everyone for a while.
- I'll get back to you on that.
Learning and techniques

You prefer to learn alone using self-study. When you spend time with an instructor or a teacher, you often only clarify information you haven’t be able to clarify yourself. You may dislike learning in groups.

Don’t be afraid to ask questions like 'What's in this for me?' 'Why does this matter?', 'How can I use this idea?' Be aware of your inner thoughts and feeling towards various topics. This is because these inner thoughts have more of an impact on your motivation and ability to learn than they do in the other styles. Here are a few ideas to help this along:

- **Spend more time on the 'Target' step of the Memletic Approach.** Set your goals, objectives and plans. Define ultra-clear visualizations or scripts of what life is like once you've achieved your goals. Understand your reasons for undertaking each objective, and ensure that you are happy with your learning goals.

- **Align your goals and objectives with personal beliefs and values.** If there is misalignment, you may run into issues with motivation or confidence. It’s not always obvious what the underlying cause is. If you suspect a misalignment, try some of the techniques like 'five whys' and 'seventy by seven' to flush these issues out. Scripting and assertions also help highlight issues. If you script your goal and you find you don't like certain parts of it, that’s probably a hint that you have some misalignment.

- **Create a personal interest in your topics.** An example for pilots might be to learn more about other aviators, both current and past. Why do others find aviation interesting? What is in it for them? What keeps them motivated? Why do they work in the field? You may also want to look at the people behind your books or material. What was their motivation to create it? Why do you think they organized the material in the way they did? Can you ask them?

- **Keep a log or journal.** You may want to keep one separate from your normal journal or training log. Include extra information about your thoughts and feelings. Outline your challenges, ideas on how to overcome them, and what worked. Write down what works well and doesn't work well for you. While you are studying, be aware of thoughts or concerns that arise. Write them down and come back to them. Discuss with others later if needed. Bear in mind it may be more efficient to put something that confuses you aside, and ask others later. This is often better than spending too much time trying to work it out yourself.

- **When you associate and visualize, highlight what you would be thinking and feeling at the time.** You may want to do most of your visualization and association in private. I suggest you also try talking to others with more experience to get some idea of what thoughts and feelings they have in various circumstances.
• Assertions are important for you. You drive yourself by the way you see yourself internally. Assertions are a good way to ensure your internal self-image matches your learning objectives. This also applies to the scripting techniques, so include your internal thinking and feelings in your scripts.

• Modeling is a powerful technique for you. Don't just model behaviors and appearance. Try to get 'inside their heads' and model the thought patterns and feelings you believe they have in various circumstances. You can gain ideas by talking to people or reading biographies. Remember you don't have to find a single perfect model. Create a model that combines several people.

• Be creative with role-playing. You don't always need other people to role-play with, because you can create plenty of people using visualization! For example, you can visualize your instructor beside you, or a colleague and you practicing a procedure or skill. Work with them and talk to them while you visualize. An advantage of this form of role-playing is that you can control their behavior!

• When changing behaviors and habits, you need to have a strong desire to make the changes you want. Explore the benefits of making a change, and visualize scenarios in which you've already made the change. If you don't believe strongly in the benefits, you may find it difficult to change the behavior.

• Your thoughts have a large influence on your performance and often safety. Your thoughts are just as much part of a system as is the physical equipment you are using, such as an aircraft, car or boat. In addition, other people are also part of those systems, so be aware that their thoughts and feelings can affect the overall system.

• Years of refinement have made physical equipment, such as aircraft and boats, safe and reliable. For example, aircraft failure causes less than ten percent of all aircraft accidents. The largest percentage is pilot error, more than seventy percent. This is likely the case in many other fields. It's just not as visible when accidents happen. It's well worthwhile spending some time refining the reliability of your own systems.
2.3.3-Four stages of learning:

There is a wealth of information, both on the shelves of libraries and on the Internet, which addresses the different learning theories that have been suggested over the past three or four decades. Those most often quoted are Kolb and Gardner. While most theorists disagree, or come from a different approach about learning styles, it is generally accepted that there are basically four stages of learning.

1. **Exposure Stage**—the first time a concept (such as long division) is new to us.

2. **Guided Learning Stage**—when we still can’t do the problems without help. This is where most people get stuck.

3. **Independent Stage**—with review, guidance, and hard work, we reach stage 3.

4. **Mastery Stage**—comes with more practice, final goal of education.

Regardless of how a student learns, the stages remain the same. It is up to the instructor and the curriculum content developer to assist a student in getting past the guided learning stage to become an independent learner, thus building on newly gained learning concepts or skills.

It has also been shown through repeated studies that students learn in different ways, or through a combination of different ways, thus supporting Smith and Kolb's learning cycle concept.

![How Students Learn](image)

*Figure 2.3.3.1: how students learn*
Chapter 2

Figure 2.3.3.1: Edgar Dale's cone of learning
2.4-Our project’s Educational role:

As we’ve previously reviewed in this chapter, Egypt is suffering from a lot of problems in its educational system, which strongly encouraged us to think of a solution that’s related to our field, that helps solving the previous stated problems; that’s when the idea of creating an educational system using our kits came to our mind.

Our project’s educational system will support the following:

1. Provide a technical skill directly related to the labor market.
2. Provide an automated step by step learning system that will guide the user in implementing the circuits from scratch.
3. It strongly supports technical education, it might be a start to other similar technical educational projects.
4. It supports visual and aural learning styles by the step by step guide through the mobile application.
5. It supports physical and logical learning styles, through the hardware circuit implementation kit.
6. It supports solitary learning style, as the user can work alone with the aid of the mobile application only.
7. It supports social learning style, due to the score calculation system in the mobile application, as users can gather up and compete with each other’s for achieving the highest scores for implementing the circuits.
8. It supports the four learning stages, as the user will be exposed to the real world circuit components, guided from scratch into implementing a real functioning circuit, being independent as the user will be able to implement whichever circuit he desires using the hardware kit, and master the implementation of any circuit after he/she completes all the available levels.
9. Supports all the stages of Edgar’s cone of learning, especially learning by doing
Chapter Three: Project Hardware
3.1-Hardware conceptual view:

We aim to use the currently available electronic components and materials, put them in customized cases that appear more simple and attractive to the kids; simplify the way they’re put together and ensure maximum safety that can be provided to the user.

These are the points that should be covered in the hardware as a whole:

- Colorful attractive components’ casings
- Simple way to connect the components together
- Insulated casings to ensure maximum safety of the user
- Variety of interactive circuits to be implemented

3.2-Used Materials:

3.2.1-Electronic components:

1. Resistors
2. Capacitors
3. Light Emitting Diodes (LEDs)
4. Relays
5. Integrated Circuits (ICs)
6. Batteries
7. Copper wires
3.2.2-Magnetic buttons:

Also known as Magnetic Snap 18mm, these are relatively large 18mm diameter snaps (all three pieces come as shown in Figure 3.2.2.1 and Figure 3.2.2.2). They couple together very strongly (must be pried apart), rotate freely on the axis, and are electrically conductive. We’ve seen snaps like these soldered onto PCBs and batteries to form a strong, but quick disconnect mechanism. Overall connection resistance is less than 200 miliOhm. Snaps will couple when closer than 10mm.

These snaps will be the core of our hardware kit, as the female part of the snap will be lined in a matrix form to be used as the ordinary existing board that we know about, while the male parts will be attached to the electronic components, this is the easiest and most efficient way to connect the components together in a safe, convenient form to the kids.

3.2.3-Plastic toy blocks:

Toy blocks (also building bricks, building blocks, or simply blocks), are wooden, plastic or foam pieces of various shapes (square, cylinder, arch, triangle, etc.) and colors that are used as construction toys. We’ve picked the plastic ones due to its availability and the easy of manipulating its shape.

---

7 SparkFun electronics
3.2.4-Solder wick:

Which is commonly used in the desoldering process, which refers to the removal of solder and components from a circuit board for troubleshooting, repair, replacement, and salvage.

In our project, we’ve used it to connect the female magnetic snap parts together in a matrix form, the wick is highly conductive and has a thick diameter, which will ensure the connectivity between them. Figure 2.2.4.2 shows how we connected them in the first prototype.

-Figure 3.2.4.1: Solder wick pack-

-Figure 3.2.4.2: wick usage in a primitive prototype-
3.2.5-Hardware components working together:

To make it clearer, here’s our first trial in using all the previous components together:

-Figure 3.2.5.1: First prototype-

-Figure 3.2.5.2: First prototype-
3.2.6-Arduino Uno R3 Module:

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It’s an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board, also it can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can communicate with software running on your computer (e.g. Flash, Processing, MaxMSP.) The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free.

The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.

There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Netmedia's BX-24, Phidgets, MIT's Handyboard, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package. Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems:

Inexpensive - Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than $50

Cross-platform - The Arduino software runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.

Simple, clear programming environment - The Arduino programming environment is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with the look and feel of Arduino.

Open source and extensible software- The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to.

Open source and extensible hardware - The Arduino is based on Atmel's ATMEGA8 and ATMEGA168 microcontrollers. The plans for the modules are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard.

---

8 arduino.cc
version of the module in order to understand how it works and save money.
Revision 3 “R3” has the following new features:

- 1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible with both the board that uses the AVR, which operates with 5V and with the Arduino Due that operates with 3.3V. The second one is a not connected pin that is reserved for future purposes.
- Stronger RESET circuit.
- Atmega 16U2 replace the 8U2.

Summary

<table>
<thead>
<tr>
<th>Microcontroller</th>
<th>ATmega328</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Voltage</td>
<td>5V</td>
</tr>
<tr>
<td>Input Voltage (recommended)</td>
<td>7-12V</td>
</tr>
<tr>
<td>Input Voltage (limits)</td>
<td>6-20V</td>
</tr>
<tr>
<td>Digital I/O Pins</td>
<td>14 (of which 6 provide PWM output)</td>
</tr>
<tr>
<td>Analog Input Pins</td>
<td>6</td>
</tr>
<tr>
<td>DC Current per I/O Pin</td>
<td>40 mA</td>
</tr>
<tr>
<td>DC Current for 3.3V Pin</td>
<td>50 mA</td>
</tr>
<tr>
<td>Flash Memory</td>
<td>32 KB (ATmega328) of which 0.5 KB used by bootloader</td>
</tr>
<tr>
<td>SRAM</td>
<td>2 KB (ATmega328)</td>
</tr>
<tr>
<td>EEPROM</td>
<td>1 KB (ATmega328)</td>
</tr>
<tr>
<td>Clock Speed</td>
<td>16 MHz</td>
</tr>
</tbody>
</table>
Input and Output

Each of the 14 digital pins on the Uno can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

- **Serial**: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.
- **External Interrupts**: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.
- **PWM**: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite() function.
- **SPI**: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.
- **LED**: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it’s off.
- **The Uno has 6 analog inputs**, labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though it is possible to change the upper end of their range using the AREF pin and the analogReference() function. Additionally, some pins have specialized functionality:
  - **TWI**: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.
  - **There are a couple of other pins on the board**: AREF. Reference voltage for the analog inputs. Used with analogReference().
  - **Reset**: Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.
**Power pins:**

- **VIN.** The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

- **5V.** This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it.

- **3V3.** A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.

- **GND.** Ground pins.

- **IOREF.** This pin on the Arduino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs for working with the 5V or 3.3V.
3.2.7-Bluetooth HC-06 module:

HC-06 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH(Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mm x 27mm.

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9 ITead Studio
Specifications

Hardware features:

- Typical -80dBm sensitivity
- Up to +4dBm RF transmit power
- Low Power 1.8V Operation, 1.8 to 3.6V I/O
- PIO control
- UART interface with programmable baud rate
- With integrated antenna
- With edge connector

Software features:

- Default Baud rate: 38400, Data bits: 8, Stop bit: 1, Parity: No parity, Data control: hasSupported baud rate: 9600, 19200, 38400, 57600, 115200, 230400, 460800.
- Given a rising pulse in PIO0, device will be disconnected.
- Status instruction port PIO1: low-disconnected, high-connected;
- PIO10 and PIO11 can be connected to red and blue led separately. When master and slave are paired, red and blue led blinks 1 time/2s in interval, while disconnected only blue led blinks 2 times/s.
- Auto-connect to the last device on power as default.
- Permit pairing device to connect as default.
- Auto-pairing PINCODE: “0000” as default
- Auto-reconnect in 30 min when disconnected as a result of beyond the range of connection.
Chapter Four: Project Software
4.1-Software concept:

We aim to lead a revolution in the field of learning electronics, and in the field of learning in general which can be achieved by “learning by doing” technique, this is what made us think of developing a game that’s linked to a change done in reality, we decided to develop an android game, linked to our hardware kits, in other words, the changes done to the hardware kits like a circuit implementation, can be sensed by the android application through the Bluetooth module and a certain score will be calculated according to the time of circuit completion for example, aside of unlocking a new circuit after the user is able to implement the current one.

The software application should contain the following:

1. Full guide to every project that can be done with the current kit
2. Leveling system
3. Score calculation system
4. Bluetooth connection protocol
5. Ability to sense changes done to the hardware

4.2-Comparison between mobile operating systems:

Microsoft's Windows Phone was met with rave reviews from day one of its launch back in late 2010, but despite its beautiful and smooth UI it hasn't caught up with users. One way or another, part of the blame for this was some immaturity of the platform - multitasking arrived later and it was very limited, the apps weren't there, customization was somewhat limited, and the list just went on and on, depending on how much you want to pick the nits.

But it was clear Windows Phone 7 wasn't as mature as iOS or Android. It was damn close, but not on par. Now, with the announcement of Windows Phone 8 Microsoft is making one giant leap towards the market leading platforms, and matches them in a lot of aspects. We'd say it even outpaces iOS and possibly Android with its new stunning Start Screen which makes us feel we won't miss widgets too much.

The real change happens under the hood, though. Windows Phone 8 now runs on the Windows NT kernel, the same kernel Windows 8 runs on. This means that you get support for multi-core chips and you'd get faster ports of apps and easier overall development across platforms. This will strengthen Microsoft’s ecosystem. And with the addition of offline maps by Nokia, it's one step ahead of the competition there as well.

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10 phonearena.com
Here’s a quick comparison between mobile operating systems:

<table>
<thead>
<tr>
<th>Feature</th>
<th>iOS 6.0</th>
<th>Android 4.1</th>
<th>Windows Phone 8</th>
<th>Windows Phone 7.8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Apps</strong></td>
<td>650,000+</td>
<td>600,000+</td>
<td>100,000+</td>
<td>100,000+</td>
</tr>
<tr>
<td><strong>Multitasking</strong></td>
<td>yes limited</td>
<td>yes</td>
<td>yes limited</td>
<td>yes limited</td>
</tr>
<tr>
<td><strong>Widgets</strong></td>
<td>no</td>
<td>yes</td>
<td>expandable Live Tiles</td>
<td>expandable Live Tiles</td>
</tr>
<tr>
<td><strong>Expandable storage</strong></td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td><strong>Multi-core processors</strong></td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td><strong>High-res displays</strong></td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td><strong>File manager</strong></td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td><strong>Drag and drop file management</strong></td>
<td>no requires iTunes</td>
<td>yes</td>
<td>no requires Zune</td>
<td>no requires Zune</td>
</tr>
<tr>
<td><strong>Intelligent voice assistant</strong></td>
<td>yes</td>
<td>yes with Google Now</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td><strong>Sideloading apps</strong></td>
<td>Cyclia</td>
<td>yes many outlets</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td><strong>Centralized notifications</strong></td>
<td>yes drop-down pane</td>
<td>yes drop-down pane</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td><strong>Flash support</strong></td>
<td>no</td>
<td>yes</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td><strong>Native screenshots</strong></td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td><strong>Offline maps</strong></td>
<td>no paid apps</td>
<td>yes</td>
<td>yes</td>
<td>no only Lumias</td>
</tr>
<tr>
<td><strong>Core</strong></td>
<td>Darwin</td>
<td>Linux</td>
<td>Windows NT</td>
<td>Windows CE 7</td>
</tr>
<tr>
<td><strong>USB Host</strong></td>
<td>limited via Camera Connection Kit</td>
<td>yes</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

-Table 4.2.1 mobile OS comparison-
4.2.1-Reason for choosing android:

1. It’s open source
2. It’s widely spread in Egypt, and available to the kids
3. As it’s installed on a mobile, which will make it highly mobile and portable

The following information was collected by MIT, through monitoring the number of tweets that were tweeted from all over Egypt, and the type of OS that was used to tweet it, whether it was Android, IOS, or Blackberry, through 3.5 million geolocated tweets from October 2012 to June 2013. **Red dots represent the location of tweets posted by Android users;** Green dots – iPhone; Purple – Blackberry.
From the previous information we can conclude that Android is the most widely common OS used by Egyptians.
4.3-Android Application:

4.3.1-Introduction about android:

Android is an operating system based on the Linux kernel with a user interface based on direct manipulation, designed primarily for touchscreen mobile devices such as smartphones and tablet computers. The operating system uses touch inputs that loosely correspond to real-world actions, like swiping, tapping, pinching, and reverse pinching to manipulate on-screen objects, and a virtual keyboard. Despite being primarily designed for touchscreen input, it also has been used in televisions, games consoles, digital cameras, and other electronics.

As of 2011, Android has the largest installed base of any mobile OS and as of 2013, its devices also sell more than Windows, iOS and Mac OS devices combined. As of July 2013 the Google Play store has had over 1 million Android apps published, and over 50 billion apps downloaded. A developer survey conducted in April–May 2013 found that 71% of mobile developers develop for Android.

Android's source code is released by Google under open source licenses, although most Android devices ultimately ship with a combination of open source and proprietary software. Initially developed by Android, Inc., which Google backed financially and later bought in 2005, Android was unveiled in 2007 along with the founding of the Open Handset Alliance—a consortium of hardware, software, and telecommunication companies devoted to advancing open standards for mobile devices.
4.3-MIT App Inventor 2:

We’ve used this tool to develop the android application, App Inventor is a cloud-based tool, which means that you can build apps right in your web browser. This website offers all of the support that you’ll need as you learn how to build your own apps. The App Inventor software, or “service” is at ai2.appinventor.mit.edu. You can get there by clicking the orange "Create" button from any page on this website.

4.3.1-Setting up App inventor:

You can set up App Inventor and start building apps in minutes. The Designer and Blocks Editor now run completely in the browser (aka the cloud). To see your app on a device while you build it (also called "Live Testing"), you’ll need to follow the steps below:

- If you are using an [Android device and you have a wireless internet connection], you can start building apps without downloading any software to your computer. You will need to install the App Inventor Companion App for your device. Choose option one below. This option is STRONGLY RECOMMENDED
- If you do not have an [Android device], you'll need to install software on your computer so that you can use the on-screen Android emulator. Choose option two below.
- If you do not have a wireless internet connection, you'll need to install software on your computer so that you can connect to your Android device over USB. Choose option three below. The USB Connection option can be tricky, especially on Windows. Use this as a last resort.

Option one - Connect your Phone or Tablet over WiFi:

You can use App Inventor without downloading anything to your computer! You’ll develop apps on website: ai2.appinventor.mit.edu. To do live testing on your Android device just install the MIT App Inventor Companion app on your Android phone or tablet. Then open your project in App Inventor on the web, open the companion on your device, and you can test your apps as you build them:

-Figure 4.3.1 option one-

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13 appinventor.mit.edu
The following steps will guide you through the process:

**Step 1: Download and install the MIT AI2 Companion App on your phone.**

Open your device's QR code scanner and scan the QR code on the left below to download the Companion App from the Play Store. If you can't use the Play Store, use the QR code on the right to download the Companion App directly to your phone.

*Play Store Recommended: Automatic updates*

Scan this QR code
to get the app from the Play Store

![QR Code for Play Store](image1)

**APK File**

Scan this QR code
to download the app directly

![QR Code for APK](image2)

Note: If you need a QR code scanner, you can get one at the Play Store (e.g., ZXing).

After downloading, step through the instructions to install the Companion app on your device. You need to install the MIT AI2 Companion only once, and then leave it on your phone or tablet for whenever you use App Inventor.

*Note 1:* If you are unable to use the QR code, you can still install MIT AI2 Companion on your phone or tablet. Use the Web browser on your device to go to the Google Play Store; look for MIT AI2 Companion in the store. Once you find Companion, click the INSTALL button for the Companion app.

*Note 2:* If you choose not to go through the Play store and instead load the app directly (aka "side load), you will need to enable an option in your device's settings to allow installation of apps from "unknown sources". To find this setting on versions of Android prior to 4.0, go to "Settings > Applications" and then check the box next to "Unknown Sources". For devices running Android 4.0 or above, go to "Settings > Security" or "Settings > Security & Screen Lock" and then check the box next to "Unknown Sources" and confirm your choice.
Step 2: Connect both your computer and your device to the SAME WiFi Network.

App Inventor will automatically show you the app you are building, but only if your computer (running App Inventor) and your Android device (running the Companion) are connected to the same WiFi Network.

Step 3: Open an App Inventor project and connect it to your device.

Go to App Inventor and open a project (or create a new one -- use Project > Start New Project and give your project a name). Then Choose "Connect" and "AI Companion" from the top menu in the AI2 browser:

![Figure 4.3.1.2 step 3-1-](image)

A dialog with a QR code will appear on your PC screen. On your device, launch the MIT App Companion app just as you would do any app. Then click the “Scan QR code” button on the Companion, and scan the code in the App Inventor window:

![Figure 4.3.1.3: step 3-2-](image)

Within a few seconds, you should see the app you are building on your device. It will update as you make changes to your design and blocks, a feature called “live testing”.

If you have trouble scanning the QR code or your device does not have a scanner, type the code shown on the computer into the Companion’s text area on your Android device exactly as shown. The code is directly below where the screen on your PC shows "Your code is" and
Chapter 4

consists of six characters. Type the six characters and choose the orange "Connect with code". Do not type an Enter or carriage return: type just the six characters followed by pressing the orange button.

**Option - 2 Installing and Running the Emulator in Al2:**

If you do not have an Android phone or tablet, you can still build apps with App Inventor. App Inventor provides an Android emulator, which works just like an Android but appears on your computer screen. So you can test your apps on an emulator and still distribute the app to others, even though the Play Store. Some schools and after-school programs develop primarily on emulators and provide a few Androids for final testing.

![Emulator Image]

*Figure 4.3.1.4: Option two*

To use the emulator, you will first need to first install some software on your computer (this is not required for the wifi solution). Follow the instructions below for your operating system, then come back to this page to move on to starting the emulator.

**Step 1. Install the App Inventor Setup Software**

Installing App Inventor 2 Setup on Windows

Installing the Windows software for App Inventor Setup has two parts:

1. Installing the App Inventor Setup software package. This step is the same for all Android devices, and the same for Windows XP, Vista, and 7.

2. If you choose to use the USB cable to connect to a device, then you'll need to install Windows drivers for your Android phone.

NOTE: App Inventor 2 does not work with Internet Explorer. For Windows users, we recommend using either Chrome or Firefox as your browser for use with App Inventor.
Step 2. Launch aiStarter (Windows & Linux only)

The emulator requires the use of a program named aiStarter. This program is the helper that permits the browser to communicate with the emulator. The aiStarter program was installed when you installed the App Inventor Setup package. There will be shortcuts to aiStarter from your Desktop, Start menu, All Programs and from Startup Folder (Windows only).

To launch aiStarter, double click on its icon. You'll know that you've successfully launched aiStarter when you see a window like the following:

![Successful aiStarter launch](image)

Step 3. Connect to Emulator

From App Inventor's menu (on the App Inventor cloud-based software at ai2.appinventor.mit.edu), go to the Connect Menu and click the Emulator option.

![Selecting Emulator option](image)
You’ll get a notice saying that the emulator is connecting. Starting the emulator can take a
couple of minutes. You may see update screens like the following as the emulator starts up:

![Figure 4.3.1.7: Emulator running checkup]

The emulator will initially appear with an empty black screen. Wait until the emulator is ready,
with a colored screen background. Even after the background appears, you should wait until
the emulated phone has finished preparing its SD card: there will be a notice at the top of the
phone screen while the card is being prepared. When connected, the emulator will launch and
show the app you have open in App Inventor.
Option - three Connecting to a phone or tablet with a USB cable:

When you use App Inventor with a phone or tablet, that device communicates with the App Inventor software running in your computer's browser window. This communication is managed by the AI2 Companion App running on the device. The instructions below (step 2) explain how to install the companion. The Companion can communicate with your computer over a wireless connection.

This is the method strongly recommended by the App Inventor team. It does not require any additional software to be installed on your computer. (See Option 1, under Setting up App Inventor.)

There are, however, some environments where wireless connections won't work. These include some hotels, conference centers, and schools that configure their wireless networks to prohibit two devices on the network from communicating with each other. See How Does my Android Device Connect Over Wifi? For a short explanation. Some App Inventor users have solved this problem by purchasing a wireless router and setting up their own local network. (Also, most Macs and some PC can serve as WiFi routers that can handle a small number of machines.) But where even this is impossible, you can still use App Inventor with a phone or tablet if you connect it to the computer with a USB cable.

Setting up a USB connection can be awkward, especially on Windows machines, which need special driver software to connect to Android devices. (This is not the case with Mac or Linux, which do not need special drivers.) Unfortunately, different devices may require different drivers, and, outside of a few standard models, Microsoft and Google have left it to the device manufacturers to create and supply the drivers. As a consequence, that you may have to search on the Web to find the appropriate driver for your phone. App Inventor provides a test program that checks if your USB-connected device can communicate with the computer. You should run this test and resolve any connection issues before trying to use App Inventor with USB on that device.
Here are the steps for beginning to use App Inventor with the USB cable:

Step 1: Install the App Inventor Setup Software
On Windows:

Installing the Windows software for App Inventor Setup has two parts:

1. Installing the App Inventor Setup software package. This step is the same for all Android devices, and the same for Windows XP, Vista, and 7.

2. If you choose to use the USB cable to connect to a device, then you'll need to install Windows drivers for your Android phone.

**NOTE: App Inventor 2 does not work with Internet Explorer. For Windows users, we recommend using either Chrome or Firefox as your browser for use with App Inventor.**

Step 2: Download and install the MIT AI2 Companion App on your phone.

Open your device's QR code scanner and scan the QR code on the left below to download the Companion App from the Play Store. If you can't use the Play Store, use the QR code on the right to download the Companion App directly to your phone.

For more details: Review Step 2 on Option one.

Step 3. Launch aiStarter (Windows & GNU/Linux only)

Communicating between the computer and the phone or tablet requires a program named aiStarter. The aiStarter program was installed when you installed the App Inventor Setup package. There will be shortcuts to aiStarter from your Start menu, from the Desktop, and from All Programs (Windows only). Windows and Linux: Every time you want to use USB with App Inventor, you will need to manually launch the aiStarter on your computer.

Step 4: Set up your device for USB (Turn USB Debugging ON)

On your Android device, go to System Settings, Developer Options, turn them on, and be sure that "USB Debugging" is allowed.

On most devices running Android 3.2 or older, you can find this option under Settings > Applications > Development.

On Android 4.0 and newer, it's in Settings > Developer options.

Note: On Android 4.2 and newer, Developer options is hidden by default. To make it available, go to Settings > About phone and tap Build number seven times. Return to the previous screen to find Developer options, including "USB Debugging".
Step 5: Connect your computer and device, and authenticate if necessary.

Connect your Android device to the computer using the USB cable - be sure that the device connects as a "mass storage device" (not "media device") and that it is not mounted as a drive on your computer. This may mean that you have to go to the Finder (on a Mac) or My Computer (on Windows) and disconnect any drive(s) that were mounted when you connected your Android device.

On Android 4.2.2 and newer, your device will pop up a screen with the message *Allow USB Debugging?* the first time you connect it to new computer. Press "OK". This authenticates the computer to the device, allowing the computer to communicate with it. You'll need to do this for each computer you want to connect to the device, but only once per computer.

Step 6: Test the connection.

Check if your computer has detected the connection.
4.3.2-MIT App Inventor 2 Designer and Blocks Editor:

Design the App's User Interface by arranging both on and off-screen components.

Program the app's behavior by putting blocks together.
4.3.3- Sharing and Packaging Apps:

You can share the app in an executable form (.apk) that can be installed on a device, or in source code form (.aia) that can be loaded into App Inventor and remixed. You can also distribute your app on the Google Play Store.

Sharing your app so that others can remix (.aia file)

Make sure you are viewing the list of all of your projects (if you are not, choose Projects | My Projects). Select the project you wish to share by checking the box next to it. Choose Project | Export selected project (.aia) to my computer to export the source code (blocks) for your project. The source code is downloaded in a .aia file.

![Exporting as aia file](image1.png)

- Figure 4.3.3.1: Exporting as aia file-

If you send it to a friend, they can open it with Project | Import project (.aia) from my computer.

![Importing aia file](image2.png)

- Figure 4.3.3.2: Importing aia file-
Sharing the app for others to install on their phone/tablet (.apk file), package the app (.apk file) by going to the "Build" menu on the App Inventor toolbar.

Select "App (save .apk to my computer)." A pop-up box should alert you that your download has begun. Note: The other option (provide QR code for .apk) produces a scannable QR code that will download the app ONLY for the person who owns the project in App Inventor. Do not distribute the QR code to others because it will not work for them.

Once the build completes, you can email the app (".apk" file) to your friends who can install it by opening the email from their phone. If you want to distribute it more widely, you can upload it to a website that both you and your friend can access. You can also distribute your app on the Google Play Store.

NOTE: Anyone installing your app (which is an " .apk" file) will need to change the setting on their phone to allow installation of non-market applications:

To find this setting on versions of Android prior to 4.0, go to "Settings > Applications" and then check the box next to "Unknown Sources". For devices running Android 4.0 or above, go to "Settings > Security" or "Settings > Security & Screen Lock" and then check the box next to "Unknown Sources" and confirm your choice.

Note: The source code (.aia) files are not executable Android programs -- those are .apk files. The source code is also not Java SDK code -- it can only be loaded into App Inventor.
4.3.4-Our project's application design:

Stage 1 – Getting started
This is what’ll appear and how the application will behave:

- Figure 4.3.4.1: App intro-
Chapter 4

-Figure 4.3.4.2: App requesting Bluetooth permission-

-Figure 4.3.4.3: Pairing button-
Figure 4.3.4.5: Successful pairing
Stage 2 – Choosing a project

Projects list design blocks:
This is what’ll appear and how the application will behave:

-Figure 4.3.4.6: Projects list-

-Figure 4.3.4.7: Pressing back button in projects menu-
Stage 3 – Getting Ready

Design blocks:

- **when** `Project01.Initialize`
  - **do**
    - **if** `not BluetoothClient1.Enabled`
      - **then**
        - call `as_TurnOnBT.StartActivity`
        - set `Connect.Elements` to `BluetoothClient1.AddressesAndNames`

- **when** `Connect.BeforePicking`
  - **do**
    - set `Connect.Elements` to `BluetoothClient1.AddressesAndNames`

- **when** `Connect.AfterPicking`
  - **do**
    - set `Connect.Selection` to call `BluetoothClient1.Connect` address "00:14:03:18:23:89"
    - **if** `BluetoothClient1.IsConnected` = true
      - then
        - set `Connect.Visible` to false
        - set `Label1.Visible` to true
        - set `Label2.Visible` to true
        - set `Score.Visible` to true
        - set `Counter.Visible` to true
        - set `Counter.Text` to "100"
        - set `Image1.Visible` to true
        - set `ClockScore.TimerEnabled` to true
        - set `ClockConnection.TimerEnabled` to true

- **when** `ClockScore.Timer`
  - **do**
    - set `Counter.Text` to `Counter.Text - 1`
    - **if** `Counter.Text` = 0
      - then
        - set `ClockScore.TimerEnabled` to false
        - set `timeout.Visible` to true
        - set `Counter.Text` to "0"
Chapter 4

when ClockConnection.Timer: if BluetoothClient1.IsConnected:
  set Output.Text to "0"
  call BluetoothClient1.ReceiveText
  number0Bytes: call BluetoothClient1.BytesAvailableToReceive

then call NotifierResult.ShowMessageDialog
  message: Counter.Text
  title: "Your score is"
  buttonText: "OK"
  call BluetoothClient1.Disconnect

set ClockScore.TimerEnabled to false
set ClockConnection.TimerEnabled to false
set Connect.Visible to true
set Connect.Text to "Retry"
set another_project.Visible to true
set Score.Visible to false
set Counter.Visible to false
set timeout.Visible to false

when NotifierResult.AfterChoosing.choice:
  do if get choice = "OK"
  then call BluetoothClient1.Disconnect

  set ClockScore.TimerEnabled to false
  set ClockConnection.TimerEnabled to false
  set Connect.Visible to true
  set Connect.Text to "Retry"
  set another_project.Visible to true
  set Score.Visible to false
  set Counter.Visible to false
  set timeout.Visible to false

when another_project.Click:
do open another screen screenName: "Projects"
This is how the application will behave:

-Figure 4.3.4.8: Ready to start connection between the app and the kit-
Figure 4.3.4.9: Pressing back on ready screen

-Figure 4.3.4.10: Pressing ready while the kit is disconnected-
Chapter 4

Figure 4.3.4.11: Project completion display

The displayed circuit in Figure above is the circuit the user is currently implementing, once it’s completed the hardware kit senses the correct output and the application returns a calculated score based on the time of completion.

Figure 4.3.4.12: Time out display
4.4-Arduino software:

The Arduino integrated development environment (IDE) is a cross-platform application written in Java, and is derived from the IDE for the Processing programming language and the Wiring projects. It is designed to introduce programming to artists and other newcomers unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and is also capable of compiling and uploading programs to the board with a single click. A program or code written for Arduino is called a "sketch".

Arduino programs are written in C or C++. The Arduino IDE comes with a software library called "Wiring" from the original Wiring project, which makes many common input/output operations much easier. Users only need define two functions to make a runnable cyclic executive program:

setup(): a function run once at the start of a program that can initialize settings

loop(): a function called repeatedly until the board powers off

A typical first program for a microcontroller simply blinks an LED on and off. In the Arduino environment, the user might write a program like this

```c
#define LED_PIN 13

void setup () {
  pinMode (LED_PIN, OUTPUT); // Enable pin 13 for digital output
}

void loop () {
  digitalWrite (LED_PIN, HIGH); // Turn on the LED
  delay (1000); // Wait one second (1000 milliseconds)
  digitalWrite (LED_PIN, LOW); // Turn off the LED
  delay (1000); // Wait one second
}
```

It is a feature of most Arduino boards that they have an LED and load resistor connected between pin 13 and ground; a convenient feature for many simple tests. The previous code

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would not be seen by a standard C++ compiler as a valid program, so when the user clicks the "Upload to I/O board" button in the IDE, a copy of the code is written to a temporary file with an extra include header at the top and a very simple main() function at the bottom, to make it a valid C++ program.
4.4.1-Arduino code:

```c
// This module work as Slave
// Upload this sketch into Arduino and press reset.

#include <SoftwareSerial.h> //Software Serial Port
#define RxD 6
#define TxD 7

SoftwareSerial blueToothSerial(RxD, TxD);

void setup()
{
  Serial.begin(9600);
  pinMode(RxD, INPUT);
  pinMode(TxD, OUTPUT);
  setupBlueToothConnection();
}

void loop()
{
  char rcvChar;
  while(1){
    //check if there's any data sent from the remote bluetooth shield
    if(blueToothSerial.available()){
      rcvChar = blueToothSerial.read();
      Serial.print(rcvChar);
    }
    /*check if there's any data sent from the local serial terminal,
    you can add the other applications here*/
    if(Serial.available()){
      rcvChar = Serial.read();
      blueToothSerial.print(rcvChar);
    }
  }
  setupBlueToothConnection()
  {
    blueToothSerial.begin(38400); //Set BluetoothBee BaudRate to default baud rate 38400
    blueToothSerial.print("\r\n+STMOD=0\r\n"); //set the bluetooth work in slave mode
    blueToothSerial.print("\r\n+STAUT=1\r\n"); // Permit Paired device to connect me
    blueToothSerial.print("\r\n+STAUTO=0\r\n"); // Autoconnection should be forbidden here
    delay(3000);
    blueToothSerial.print("\r\n+INQ=0\r\n"); //make the slave bluetooth inquirable
    Serial.println("The slave bluetooth is inquirable!");
    delay(2000);
    blueToothSerial.flush();
  }
}
//This module work as Master
#include <SoftwareSerial.h> //Software Serial Port
#define RxD 6
#define TxD 7
String retSymb = "+RIINQ"; //start symbol when there's any return
String slaveName = ";ScedBTSlave";
//Set the Slave name, caution that ';' must be included
intnameIndex = 0;
intaddrIndex = 0;

String recvBuf;
String slaveAddr;

String connectCmd = "\n\nCONN=";

SoftwareSerial blueToothSerial(RxD,TxD);

void setup()
{
  Serial.begin(9600);
pinMode(RxD, INPUT);
pinMode(TxD, OUTPUT);
setupBlueToothConnection();
//wait 1s and flush the serial buffer
delay(1000);
Serial.flush();
blueToothSerial.flush();
}

void loop()
{
  char recvChar;
  while(1){
    if(blueToothSerial.available()){
      //check if there's any data sent from the remote bluetooth shield
      recvChar = blueToothSerial.read();
      Serial.print(recvChar);
    }
    if(Serial.available()){
      //check if there's any data sent from the local serial terminal,
      //you can add the other applications here*
      recvChar = Serial.read();
      blueToothSerial.print(recvChar);
    }
  }
}
void setupBlueToothConnection()
{
    blueToothSerial.begin(9600); // Set BluetoothBee BaudRate to default baud rate 38400
    blueToothSerial.print("\r\n+STMOD=1\r\n"); // set the bluetooth work in master mode
    blueToothSerial.print("\r\n+STAUTO=0\r\n"); // Auto-connection is forbidden here
    delay(2000);
    blueToothSerial.flush();
    blueToothSerial.print("\r\n+INQ=1\r\n"); // make the master inquire
    Serial.println("Master is inquiring!");
    delay(2000);

    // find the target slave
    char recvChar;
    while(1)
    {
        if (blueToothSerial.available()){
            recvChar = blueToothSerial.read();
            recvBuf += recvChar;
            nameIndex = recvBuf.indexOf(slaveName); // get the position of slave name
            if (nameIndex != -1)
            {
                Serial.println(recvBuf);
                // get the start position of slave address
                addrIndex = (recvBuf.indexOf(retSym, nameIndex - retSym.length() - 10) + retSym.length());
                slaveAddr = recvBuf.substring(addrIndex, nameIndex); // get the string of slave address
                break;
            }
        }
    }

    // form the full connection command
    connectCmd = slaveAddr;
    connectCmd += "\r\n";
    int connectOK = 0;
    Serial.println("Connecting to slave:");
    Serial.println(slaveAddr);
    Serial.println(slaveName);
    // connecting the slave till they are connected
    do{
        blueToothSerial.print(connectCmd); // send connection comma
        recvBuf = "";
        while(1)
        {
            if (blueToothSerial.available()){
                recvChar = blueToothSerial.read();
                recvBuf += recvChar;
            }
if(recvBuf.indexOf("CONNECT:OK") != -1){
    connectOK = 1;
    Serial.println("Connected!");
    blueToothSerial.print("Connected!");
    break;
} else if(recvBuf.indexOf("CONNECT:FAIL") != -1){
    Serial.println("Connect again!");
    break;
}
}
while(0 == connectOK);
Chapter Five: Hardware Software Integration
5.1- Interaction between Hardware kit and mobile application:

Scenario:

While starting the mobile application is forced to turn on the Bluetooth connectivity of the mobile device, then it asks the user to pair with the Kit, after pairing the user continues to use the application until he/she reaches the requested project.

After opening the required project, pressing “I am ready” button let the application be synchronized with the Bluetooth module of the kit and the counter starts to count for the process of calculation of the user’s score.

During the life of the project, the application is waiting for an interrupt signal (A pre-specified keyword known between the module and the application for this project) from the Bluetooth module to stop the counter and to show a message for the user announcing his/her final score.

Design blocks:

-Figure 5.1.1: Test app-
5.2-UART Protocol:

The mobile equipment (Application) is connected to the hardware (Kit) through a continuous Bluetooth connection using UART protocol

A universal asynchronous receive-transmitter, is a piece of computer hardware that translates data between parallel and serial forms. The main features:

- Full Duplex Operation
- Master or slave clocked Synchronous operation
- High Resolution Baud Rate Generator
- Data Over run Detection

The UART takes bytes of data and transmits the individual bits from the source (kit) in a sequential fashion. At the destination (Mobile), a second UART re-assembles the bits into complete bytes. Each UART contains a shift register, which is the fundamental method of conversion between serial and parallel forms.

The UART Used for communication between the Arduino board (Kit) and the mobile device. All Arduino boards have at least one serial port (also known as a UART or USART): Serial. It communicates on digital pins 0 (RX) and 1 (TX) as well as with the computer via USB. Thus, if you use these functions, you cannot also use pins 0 and 1 for digital input or output.

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5.3-Final Prototype working along with the mobile application:

This is the final shape of the hardware kit

-Figure 5.3.1: Hardware kit final prototype front view-
Note that the back of the kit will be cased with an insulating material, to ensure the safety of the user.
Chapter 6 Conclusion and future work
6.1-Conclusion:
After weeks, days and hours of hard work, we were able to create a unique product with a new idea that didn’t exist before, an interactive educational game, that teaches kids the basics and concepts of electronics at an early life stage, based on learning by doing as the user will be able to implement fully functional circuits, guided by the listed instructions and figures in the mobile application.

We were able to finalize a reliable prototype that will be a base to our future work, to us this is not just a graduation project, we see a great business potential in this project, the idea is brand new, and no such product exist in Egypt, so we have new competitors, its new, it’s educational, it’s a service to the whole community and it has a real value to the customers, surely sponsors will be interested to hear about it, and maybe interested in claiming the advantage of being the first company that supports such an idea.

Conclusion, we aim to prepare a generation that will lead a technological revolution for our country.

6.2-Future work:

6.2.1-Replacing the Arduino and with a Printed Circuit Board:
The main use of this will be reducing the size of the hardware kit and ensuring its sustainability and reliability as every component will be properly fixed, hence it won’t be affected by sudden movements or impact, there will be other advantages such as:

1. The circuit board fabrication cost is lower with mass quantity production.
2. Electronic circuit characteristics will be maintained without introducing parasite capacitance with a proper circuit board design.
3. Component wiring and assembly can be mechanized in a circuit board manufacturing facility.
4. PCBs offer uniformity of electrical characteristics from assembly to assembly.
5. The location of electronic parts is fixed and so it simplifies components identification and maintenance of equipment.
6. Inspection time is reduced because printed circuitry eliminates the probability of error.
6.2.2-Increasing the number of projects that can be implemented by the kit:

Here are some project ideas that we picked from elenco, a company that manufactures educational toys.

<table>
<thead>
<tr>
<th>Project #</th>
<th>Description</th>
<th>Project #</th>
<th>Description</th>
<th>Project #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Electric Light &amp; Switch</td>
<td>35</td>
<td>Motor Space Light</td>
<td>69</td>
<td>Space War Siren</td>
</tr>
<tr>
<td>2</td>
<td>DC Motor &amp; Switch</td>
<td>36</td>
<td>Space Battle (II)</td>
<td>70</td>
<td>Quiet Water Alarm</td>
</tr>
<tr>
<td>3</td>
<td>Sound Activated Switch</td>
<td>37</td>
<td>Silent Space Battle</td>
<td>71</td>
<td>Light-Controlled Lamp</td>
</tr>
<tr>
<td>4</td>
<td>Adjusting Sound Level</td>
<td>38</td>
<td>Periodic Sounds</td>
<td>72</td>
<td>Voice-Controlled Lamp</td>
</tr>
<tr>
<td>5</td>
<td>Lamp &amp; Fan In Series</td>
<td>39</td>
<td>Blinking Double Flashlight</td>
<td>73</td>
<td>Motor-Controlled Lamp</td>
</tr>
<tr>
<td>6</td>
<td>Lamp &amp; Fan In Parallel</td>
<td>40</td>
<td>Motor-Controlled Sounds</td>
<td>74</td>
<td>Light-Controlled LED</td>
</tr>
<tr>
<td>7</td>
<td>Light Emitting Diode</td>
<td>41</td>
<td>More Motor Sounds</td>
<td>75</td>
<td>Sound-Controlled Time Delay LED</td>
</tr>
<tr>
<td>8</td>
<td>One Direction for LED</td>
<td>42</td>
<td>More Motor Sounds (II)</td>
<td>76</td>
<td>Motor-Controlled Time Delay LED</td>
</tr>
<tr>
<td>9</td>
<td>Conduction Detector</td>
<td>43</td>
<td>More Motor Sounds (III)</td>
<td>77</td>
<td>Space War Flicker LED</td>
</tr>
<tr>
<td>10</td>
<td>Space War Alarm Combo</td>
<td>44</td>
<td>More Motor Sounds (IV)</td>
<td>78</td>
<td>Music AND Gate</td>
</tr>
<tr>
<td>11</td>
<td>Flying Saucer</td>
<td>45</td>
<td>Light-Controlled Flicker</td>
<td>79</td>
<td>Flash and Tone</td>
</tr>
<tr>
<td>12</td>
<td>Decreasing Saucer Lift</td>
<td>46</td>
<td>More Sound Effects</td>
<td>80</td>
<td>Lamp, Speaker &amp; Fan in Parallel</td>
</tr>
<tr>
<td>13</td>
<td>Two-Speed Fan</td>
<td>47</td>
<td>This OR That</td>
<td>81</td>
<td>Pencil Alarm</td>
</tr>
<tr>
<td>14</td>
<td>The Fuse</td>
<td>48</td>
<td>This AND That</td>
<td>82</td>
<td>Pencil Alarm Variants</td>
</tr>
<tr>
<td>15</td>
<td>Musical Doorbell</td>
<td>49</td>
<td>Neither This NOR That</td>
<td>83</td>
<td>Fun with the Alarm IC</td>
</tr>
<tr>
<td>16</td>
<td>Momentary Alert</td>
<td>50</td>
<td>NOT This AND That</td>
<td>84</td>
<td>Motor Sounds Combo (II)</td>
</tr>
<tr>
<td>17</td>
<td>Alarm Circuit</td>
<td>51</td>
<td>Reflection Detector</td>
<td>85</td>
<td>Motor Sounds Combo (II)</td>
</tr>
<tr>
<td>18</td>
<td>Laser Gun</td>
<td>52</td>
<td>Quieter Reflection Detector</td>
<td>86</td>
<td>Music Alarm Combo</td>
</tr>
<tr>
<td>19</td>
<td>Space War</td>
<td>53</td>
<td>Flashing Laser Light with Sound</td>
<td>87</td>
<td>Bomb Sound</td>
</tr>
<tr>
<td>20</td>
<td>Light Switch</td>
<td>54</td>
<td>Space War Flicker</td>
<td>88</td>
<td>Bomb Sound (II)</td>
</tr>
<tr>
<td>21</td>
<td>Paper Space War</td>
<td>55</td>
<td>Spinning Rings</td>
<td>89</td>
<td>Light-Controlled LED (II)</td>
</tr>
<tr>
<td>22</td>
<td>Light Police Siren</td>
<td>56</td>
<td>Strobe the House Lights</td>
<td>90</td>
<td>Touch Light</td>
</tr>
<tr>
<td>23</td>
<td>More Loud Sounds</td>
<td>57</td>
<td>Race Game</td>
<td>91</td>
<td>Touch Sound</td>
</tr>
<tr>
<td>24</td>
<td>More Loud Sounds (II)</td>
<td>58</td>
<td>Using Parts as Conductors</td>
<td>92</td>
<td>Wacky Sounds</td>
</tr>
<tr>
<td>25</td>
<td>More Loud Sounds (III)</td>
<td>59</td>
<td>Spin Draw</td>
<td>93</td>
<td>Wackier Sounds</td>
</tr>
<tr>
<td>26</td>
<td>More Loud Sounds (IV)</td>
<td>60</td>
<td>Space War Flicker Motor</td>
<td>94</td>
<td>Really Wacky Sounds</td>
</tr>
<tr>
<td>27</td>
<td>Clap Sounds</td>
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-Table 6.2.2.1: Project ideas list 1-

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### Table 6.2.2.2: Project ideas list 2

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<td>Alarm Vibrator w/ LED</td>
</tr>
<tr>
<td>681</td>
<td>Alarm Vibrator w/ LED (II)</td>
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<tr>
<td>682</td>
<td>Relay-Whistling Vibrator</td>
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<tr>
<td>683</td>
<td>Relay-Whistling Photo Vibrator</td>
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<tr>
<td>684</td>
<td>Vibration LED</td>
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<tr>
<td>685</td>
<td>Vibration Speaker</td>
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<tr>
<td>686</td>
<td>Measure the Vibration as You Tap the Switch</td>
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<tr>
<td>687</td>
<td>Shaky Birthday Song</td>
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<tr>
<td>688</td>
<td>Vibration Detector</td>
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<tr>
<td>689</td>
<td>Out of Balance</td>
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<tr>
<td>690</td>
<td>Vibration Alarm</td>
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<tr>
<td>691</td>
<td>Vibration Space War</td>
</tr>
<tr>
<td>692</td>
<td>Vibration Light</td>
</tr>
</tbody>
</table>
6.2.3 - Using Augmented Reality technology in the mobile application:

This will make the implementation guidance much easier for the user, as it will provide a 3D display of the project while being implemented.
6.2.3.1-What’s Augmented Reality Technology?

Augmented reality (AR) is a live direct or indirect view of a physical, real-world environment whose elements are augmented (or supplemented) by computer-generated sensory input such as sound, video, graphics or GPS data. It is related to a more general concept called mediated reality, in which a view of reality is modified (possibly even diminished rather than augmented) by a computer. As a result, the technology functions by enhancing one’s current perception of reality. By contrast, virtual reality replaces the real world with a simulated one. Augmentation is conventionally in real-time and in semantic context with environmental elements, such as sports scores on TV during a match. With the help of advanced AR technology (e.g. adding computer vision and object recognition) the information about the surrounding real world of the user becomes interactive and digitally manipulable. Artificial information about the environment and its objects can be overlaid on the real world.

To use augmented reality technology, our own 3D shapes should be designed using Unity; Unity is a powerful engine with a variety of tools that can be utilized to meet your specific needs. The editor is intuitive and customizable allowing you a greater freedom in your workflow.

*Figure 6.2.3.1.1: Augmented Reality technology example*-
6.2.3.2-Role of Augmented Reality in education:

Johnson, et al. (2010) stated, “AR has strong potential to provide both powerful contextual, on-site learning experiences and serendipitous exploration and discovery of the connected nature of information in the real world.”

AR has been experimentally applied to both school and business environments, although not as much as classic methods of education and training during the last two decades. In addition to that, now that the technologies that make AR possible are much more powerful than ever before and compact enough to deliver AR experiences to not only corporate settings but also academic venues through personal computers and mobile devices, several educational approaches with AR technology are more feasible. Also, wireless mobile devices, such as smart phones, tablet PCs, and other electronic innovations, are increasingly ushering AR into the mobile space where applications offer a great deal of promise, especially in education and training.

6.2.3.3-Augmented Reality applications:

The most common use of AR can be seen through mobile apps. And there is a growing batch of these available from your Mobile App Store. Popular Apps such as Aurasma, Fetch and Layar are now being implemented in educational and commercial settings.

Basically you point your device’s camera at something that the app recognizes, and it will generate a 3D animation or video superimposed over whatever is on your camera’s screen. The effect makes the computer-generated item appear like it’s really there.

Perhaps you’ve already seen this television advertisement for IKEA that enables you to Place IKEA furniture in your home with augmented reality.

Currently the use of augmented reality in an enterprise context across government and non-government includes strategic defense, business process and logistics control.

AR can be integrated across a wide variety of employee roles particularly useful where simulation, training and skills development are required. Of particular interest is rapid take-up of mobile wearable technologies that complement or build upon information systems supporting augmented reality such as Google Glass.

Take a look at this short YouTube video which focusses on Google Glass and Augmented Reality’s Future.

AR is of interest in an enterprise and industrial context given the ability to connect a user or wearer with information to enhance:

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18 Augmented Reality in Education and Training By Kangdon Lee University of Northern Colorado
19 Augmented Reality in Education and Training By Catriona Ward
Instruction – character (OCR), image, object or location recognition combined with other triggers such as RFID or Beacon that prompt the system to provide the user with instructions to undertake tasks or provide alerts to the user about that object or location.

Operations – hands-free information transmission while an operator is otherwise occupied undertaking tasks requiring hands on operations.

Engagement – provision of a range of feedback to the AR user enhancing that person’s engagement with a task such as a reward, result or other feedback.

Enjoyment – an AR user will often report that they are better engaged with a process if information that is specific and useful is presented to them for consideration.

6.2.4- Develop the mobile applications on other platforms:

This will be very useful to us as we’ll tremendously increase the number of users who’ll be able to use our products, as we’ll develop the application to work with other OS such as:

- IOS
- Unix/Mac OS
- Windows
- Windows phone

Our priorities will be set according to the following chart:

![Chart showing mobile device sales distribution]

-Figure 6.2.4.1: Mobile device sales 2Q12-

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20 Gartner report “Market Share: Mobile Devices, Worldwide, 2Q12”
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