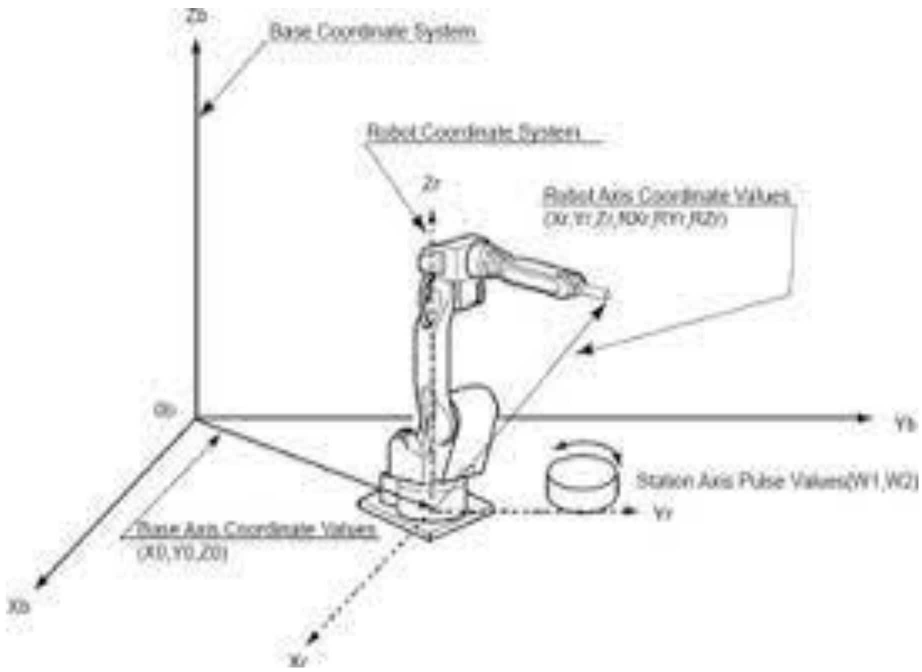
Ecole Supérieures en Sciences et Techniques. Tlemcen

4éme année Automatique

UNIT_1: Robotic Systems

Robotic systems are a way of automating manufacturing applications while reducing the amount of labor and production costs and time associated with the process. These systems are used in almost every manufacturing industry today. While manual labor has dominated in manufacturing for centuries, it is the robotic system that revolutionized the process. Manufacturers are now able to produce a superior-quality product in a reduced amount of time because of robot systems. There are three types of robotic systems; the manipulation robotic system, the mobile robotic system and the data acquisition and control robotic system. The manipulation robot system is the most commonly used in the manufacturing industry. These systems are made up of many of the robot arms with 4-6 axes and varying degrees of freedom. They can perform several different functions, including welding, material handling and material removal applications.



The mobile robotic system is a bit different. This system consists of an automated platform that moves items from one place to another. While these robot systems are used heavily in manufacturing for carrying tools and spare parts, they are also used in the agricultural industry for transporting products. These can also be used by several different industries because of their ability to swim and fly, as well as move along the ground. Data acquisition and control robotic systems are used to gather, process and transmit data for a variety of signals. They are also used in software for engineering and business. Many of the mobile robotic systems can use signals from these systems.

Terminology:

Arm: An interconnected set of links and powered joints comprising a robot manipulator that supports and/or moves a wrist and hand or end-effector through space. The arm itself does not include the end-effector.

Axis: A direction used to specify the robot motion in a linear or rotary mode.

Axis Interference: A function that judges the current position of each axis and outputs a signal based on whether the current position is within a predefined range.

Control Command: An instruction fed to the robot by means of the human-tomachine input device. See Pendant (Teaching). This command is received by the robot's controller system and is interpreted. Then, the proper instruction is fed to the robot's actuators, which enable it to react to the initial command. Many times, the command must be interpreted with the use of logic units and specific algorithms. See Input Device and Instruction Cycle.

Control Device: Any piece of control hardware providing a means for human intervention in the control of a robot or robot system, such as an emergency-stop button, a start button, or a selector switch.

Control Mode: The means by which instructions are communicated to the robot. Controller System: The robot control mechanism is usually a computer of some type, which is used to store data (both robot and work environment), and store and execute programs, which operate the robot. The Controller System contains the programs, data, algorithms; logic analysis, and various other processing activities, which enable it to perform.

End-effector: An accessory device or tool, specifically designed for attachment to the robot wrist or tool mounting plate to enable the robot to perform its intended task. (Examples may include: gripper, spot weld gun, arc weld gun, spray point gun or any other application tools.)

Manipulator: A machine or robotic mechanism of which usually consists of a series of segments (jointed or sliding relative to one another) for the purpose of grasping and/or moving objects (pieces or tools), usually in several degrees of freedom. The control of the manipulator may be by an operator, a programmable electronic controller or any logic system.

Material Handling: The process by which an industrial robotic arm transfers materials from one place to another. Degrees of Freedom: The number of independent directions or joints of the robot, which would allow the robot to move its end-effector through the required sequence of motions. For arbitrary positioning, 6 degrees of freedom are needed: 3 for position (left-right, forward-backward and up- down), and 3 for orientation (yaw, pitch and roll).

Robot: A re-programmable, multifunctional manipulator designed to move material, parts, tools or specified devices through variable programmed motions for the performance of a variety of tasks. Common elements which make up a robot are: controller, manipulator and end-effector.

Robot Coordinate System: is defined in the base axis of a Robot, and points in the Robot Coordinate System will be relative to the base of the robot. Note that by default the Base Coordinate System and Robot Coordinate System are the same.

Base Coordinate System: defines a common reference point for a cell or application. This is useful when using multiple robots or devices as positions defined in Base Coordinates will be the same for all robots and devices.

Exercise 1: (Comprehension of the text)

1. What can the manipulation robot system do?

2. In which areas data acquisition and control robotic systems can be used?

3. Describe the mobile robotic system characteristics.

4. Give the synonyms of: work, detection, elements, fabrication. 5. Give the opposites of: few, augmenting, to separate, the least.

Exercise 2: Fill in the gaps with the following words:

any, be, can, from, risk, systems, than, therefore, they, time, use, with

Although robotic (1) remove the operator (2) the immediate vicinity of the welding process and reduce the (3) from fume, arc glare, noise and radiation, (4) are in themselves a safety hazard. The robot arm (5) travel at high velocity (6) considerable force and the operator and associated staff must (7) prevented from entering the operating envelope at any (8) when the unit is active. This necessitates the (9) of mechanical guards and safety interlocks. In addition, (10) automated system can operate at much higher duty cycles than a manual operator and the total fume generated during a shift will probably be much higher (11) that produced by non-automated installations. It is (12) necessary to provide adequate fume extraction.

Exercise 3: Write a paragraph using the following sentences:

- While manual labor has dominated in manufacturing for centuries, it is the robotic system that revolutionized the process.

- Manufacturers are now able to produce a superior-quality product in a reduced amount of time because of robot systems.

- Robotic systems need to do tasks that humans alone cannot complete, such as moving large space assets or scanning large areas of planetary surfaces.

	Simple	Continuous	Perfect	Perfect Continuous
Present	**V (Vs)** I write. He writes. Do I write? Does he write? I don't write. He doesn't write. (day by day, every day, weekly, usually, often, never, sometimes, at first…, then…)	**to be am / is / are + Ving** I am writing. He is writing. Am I writing? Is he writing? I am not writing. He is not writing. (now, at the present moment..)	**have (has)+ V3(Ved)** I have written. He has written. Have I written? Has he written? I have not written. He has not writte (today, this week, this month, this year, never, ever, already, lately, since…)	**have (has) been + Ving** I have been writing. Have I been writing? I have not been writing. (for 2 hours, for a month, for the last 2 days, How long…? Since when…? Since…)
Past	**V_2** I wrote. He wrote. Did I write? Did he write? I did not write. He did not write. (yesterday, two days ago, last year, in1980, every day, often, always, at first, then…)	**was (were) + Ving** I was writing. Was I writing? I was not writing. (at 7 o'clock, at that moment, when…, while…, from…till, all day long)	**had + V3 (Ved)** I had written. Had I written? I had not written. (by 5 o'clock, by the 15th of May, by the end of the week, before)	**had been + Ving** I had been writing. Had I been writing? I had not been writing. (for 2 hours, for a month, since…)
Future	**will + V** I will write. (I shall write.) Will I write? I will not write. I won't write. (tomorrow, next week, next year, every day, often, always, at first, then)	**will be + Ving** I will be writing. Will I be writing? I will not be writing. (at 7 o'clock, when…, while…)	**will have +V3 (Ved)** I will have written. Will I have written? I will not have written. (by 7 o'clock, by the 15th of May, by the end of the week, before)	**will have been+Ving** I will have been writing. Will I have been writing? I will not have been writing. (for 2 hours, for a month, how long…,since)

<u>Use the right Tenses</u>

1.It was warm, so I ………. off my coat. (take)

2. The film wasn't very good. I ……………….it very much. (enjoy)

3. I knew Sarah was very busy, so I ……………..her. (disturb)

4. I was very tired, so I …………………..to bed early. (go)

5. The bed was very uncomfortable. I ……………………very well. (sleep)

6. Sue wasn't hungry, so she ……………….anything. (eat)

7. We went to Kate's house but she …………………..at home. (be)

9. The window was open and a bird [ ] into the room. (fly)

10. The hotel wasn't very expensive. It [ ] very much. (cost)

11. I was in a hurry, so I [ ] time to phone you. (have)

12. It was hard work carrying the bags. They [ ] very heavy. (be)

1. Let's go out. It ……………….. (not/rain) now.

2. Julia is very good at languages. She [ ] (speak) four languages

very well.

3. Hurry up! Everybody [ ] (wait) for you.

4. [ ] (you/listen) to the radio?

No, you can turn it off.

5. ________ (you/listen) to the radio every day?

No, just occasionally.

6. The River Nile ________ (flow) into the Mediterranean.

7. Look at the river. It ________ (flow) very fast today - much faster than usual.

8-9. We usually ________ (grow) vegetables in our garden but this year we ________ (not/grow) any.

10. How is your English?

Not bad. It ________ (improve) slowly.

11-12. Ron is in London at the moment. He ________ (stay) at the Park Hotel. He ________ (always/stay) there when he's in London.

13. Can we stop walking soon? I ________ (start) to feel tired.

14-15. Can you drive?

I ________ (learn). My father ________ (teach) me.

16-17. Normally I ________ (finish) work at 5.00, but this week I ________ (work) until 6.00 to earn a bit more money.

18-19. My parents ________ (live) in Bristol. They were born there and have never lived anywhere else. Where ________ (your parents/live)?

20-21. Sonia ________ (look) for a place to live. She ________ (stay) with her sister until she finds somewhere.

1. He …………..(live) in London for two years and then

……………………….(go) to Edinburgh.

2. …………………….(wear) your hair long when you were at school?

Yes, my mother ……… (insist) on it.

3. But when I ………… (leave) school I (cut) my

hair and (wear) it short ever since.

4. Shakespeare (write) a lot of plays.

5. My brother (write) several plays. He

(just / finish) his second tragedy.

6. I (fly) over Loch Ness last week.

(you/see) the Loch Ness monster?

7. I (not see) him for three years. I wonder where he is.

8. He (not smoke) for two weeks. He is trying to give

it up.

9. Chopin (compose) some of his music in Majorca.

10. When (arrive)?

11. He (arrive) at 2.00.

12. (you / lock) the door before you left the house?

13. I (read) his books when I was at school. I

(enjoy) them very much.

14. I can't go out because I ______ (not finish) my work.

15. I ______ (write) the letter but I can't find a stamp.

16. The clock is slow.

It isn't slow, it ______ (stop).

17. Here are your shoes; I ______ (just / clean) them.

35 most useful Slang Expressions for Spoken English

Slang expressions are a group of words which allow English speakers to express how they are thinking and/or how they are feeling. These slang expressions are worth learning and are not taught in schools. For English-speaking learners learning these slang expressions help them understand native speakers and gives them more confidence to use these Slang expressions themselves in their daily lives. Here are 35 most useful slang expressions in English:

Slang Expression	**Meaning**
Blew me away	When someone or something truly amazes you
Unreal	Something that is amazing or brilliant
Go the extra mile	To make a special effort to achieve a goal or piece of work
Piece of cake	This refers to when something is very easy to do or finish
Crunch time	The decision has to be made now The piece of work has to be handed in immediately
Get out of hand	A situation gets out of control
Skeleton crew	The minimum number of people needed to keep an office or restaurant or hotel open and running smoothly
Leave no stone unturned	To ensure that a situation or goal is achieved
Cry wolf	To keep wanting attention or help from others when you do not really need it
Don’t judge a book by its cover	Do not make a decision too quickly without knowing all the facts

Cost an arm and a leg	Refers to the cost of an item for sale which is very expensive
Feeling under the weather	To feel unwell and so are unable to do something as usual for example, being too ill to go to work
Pull yourself together	To stop over-reacting and to calm down and to think more clearly about the situation

https://www.spokenenglishpractice.com/slang-expressions/

American Slang Expression and their Equivalents in British English.

British English Term	American English Slang Expression	Explanation
Tire is punctured	Have a flat tire	You do not use puncture for tires or tubes in America. You got a flat tire
Stand in Queue	Stand in a line	I never heard anyone using queue in US. You just stand in a line at bus stop or in a bank
Go to Petrol Bunk	Go to Gas Station	In America, gasoline is the term for petrol and they call it gas in short form. Diesel is still Diesel in America.
Put a full stop at end of sentence.	Put a period at end of sentence.	No one uses full stop in US. It is a period
I want to post this letter	I want to mail this letter	In America, people use mail for post
I passed out in 2000 from Delhi University	I graduated in 2000 from Delhi University	In America, Pass out means faint because of loss of blood, weakness or sometimes after getting drunk too much.
We are used to saying "hash" for symbol #	In US, "#" means a pound symbol	
Turn left at the signal	Turn left at traffic lights or just lights	I have seen many people use lights for traffic signals
Don't be coward, step up.	Don't be a chicken, step up.	Chicken is used to signify that you do not have courage or you are bold enough.

	"You Bet"	Some people use, "you bet", whenever you say Thank you to them for doing a favor. It is like
		saying "You are welcome"
I am trying, but the phone is engaged.	I am trying, but the phone is busy.	You do not use the word engage in US, just phone is busy
I need to buy some alcohol or liquor for tonight	I need to buy some booze for tonight	Using booze is very common for alcohol in slang
	Bummer! I can't go to concert tonight.	"Bummer" is an expression used to express emotion and it means something that you did not expect happened and you cannot do anything about it.
Look at a place or visit the place.	Let's check out this place or just check out anything.	In slang, people use "check out" for visiting or looking at them with interest. Based on context, it can also mean you have to vacate the place like in "Check out the hotel at 11 AM"
	He just hung upon me or Just hang up the phone	"Hang up" means just disconnect the phone. It has nothing to do with hanging someone in gallows
I cannot do this buddy.	I wish I could do this buddy	It is tricky here, when some says, "I wish...." it means they cannot do it, but politely saying they cannot do it.

Vocabulary Exercise - Science and Technology

Do the exercise the vocabulary related to *science and technology*

Choose the right words:

1. The ethical implications of laboratory scientific **experiments** on animals is an issue discussed world wide.
2. The dependency to computers displayed in the behavior of certain people is called computer **addiction** .
3. Technological and scientific **tools** such as computers, cell phones, satellites ... may boost the development of the third world countries.
4. The less people have access to **information** technology the larger the **digital** divide is.
5. Computer **age** is the era in which computer technology has transformed our lives.

Vocabulary Exercise - Prefixes and Suffixes

Use a prefixes to find the opposite of these verbs:

1- **wrap**	unwrap
2- **use**	misuse
3- **agree**	disagree
4- **engage**	disengage
5- **behave**	misbehave
6- **understand**	misunderstand
7- **fold**	unfold
8- **spell**	misunderstand
9- **connect**	disconnect
10- **close**	disclose

Put the words in brackets in the appropriate form (use a prefixes or a suffixes):

1. He was acting in a very **childish** way. (child)
2. She looked **unhappy** .She started to cry. (happy)
3. He passed his exam. He was **successful** for the second time. (succeed)
4. The team that he supported were able to win the **championship** . (champion)
5. I couldn't find any **weakness** in his theory. (weak)
6. He wants to be a **mathematician** when he grows up. (mathematics)
7. There were only a **handful** of people at the match. (hand)
8. The road was too narrow, so they had to **widen** it. (wide)
9. I think that you should **reconsider** your decision. It may not be the best thing to do. (consider)

10. You need a **combination** of motivation, organization and hard work to realize your dreams.(combine)

Complete the sentences with the prefixes and suffixes below. You will only need to use each prefix / suffix once.

-able
-ist
-ing
-ive
im-
-ic
un-
-ment
-ful
-ient

Supply the right suffix :

- 1 - It's always use___ [ful] to carry some cash on you, in case of an emergency.
- 2 - Planning a holiday can be just as excit___ [ing] as going on holiday.
- 3 - I found that this medicine is the most effect___ [ive] for colds.
- 4 - She speaks arab___ [ic] very well.
- 5 - You must not be [im] ___polite to your boss.
- 6 - The CEO has been responsible for many [un] ___popular decisions.
- 7 - I'm un___ [able] to work on weekends.
- 8 - I don't want to get into an argu___ [ment] with you about this.
- 9 - Living close to the station is conven___ [ient] for me.

Vocabulary Exercise - Prefixes and Suffixes

Use a prefixes to find the opposite of these verbs:

1- **wrap**	wrap
2- **use**	use
3- **agree**	agree
4- **engage**	engage
5- **behave**	behave
6- **understand**	understand
7- **fold**	fold
8- **spell**	understand
9- **connect**	connect
10- **close**	close

Put the words in brackets in the appropriate form (use a prefixes or a suffixes):

11. He was acting in a very **..............**way. (child)
12. She looked **................** .She <u>started</u> to cry. (happy)
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14. The team that he supported were able to win the **........................** . (champion)
15. I couldn't find any **......................** in his theory. (weak)
16. He wants to be a **.............................** when he grows up. (mathematics)
17. There were only a **..........................** of people at the match. (hand)
18. The road was too narrow, so they had to **......................** it. (wide)
19. I <u>think</u> that you should **..........................** your decision. It may not be the best thing to do. (consider)
20. You need a **..........................** of motivation, organization and hard work to realize your dreams.(combine)

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Conversation

Below are examples of questions students ask. Career conversations:

- What experiences did you have in undergraduate studies that prepared you for working in industry?
- What trends do you foresee in your field?
- What traits/skills/qualities does your organization seek in interns and full-time hires?
- What technical skills do you recommend students develop if they are interested in securing an internship or job with your organization, or in your industry?
- What are the main values at work at your organization?
- How did your educational background prepare you for your current role?
- What advice/suggestions do you have for someone who wants to gain experience in your field?
- What do you know now that you wish you knew when you were in school?

Internship Conversation

- ***What's your background?***
- "I'm from Rio de Janeiro, Brazil. Portugal has an agreement with Brazil that allows you to use your national exams to get into university in Portugal. So, I studied engineering in Aveiro, Portugal. The University of Aveiro is well-known for their STEM education. I just finished

my bachelor's in Informatics and started looking for an opportunity that I received from OLX."

- ***Why did you become an engineer?***
- "I've always liked logic and mathematics. There's a lot you can do with a degree in Informatics, and I followed the path into engineering because you can do so much at scale."
- ***What projects did you work on during the internship?***
- "I started in the Engineering Ops team. Our goal was to support others teams in OLX Motors and within OLX Europe. We created internal dashboards for engineers to help them collect theirs delivery metrics. We also created an incidents reporter: We automatically track some incidents metrics from our main service in Motors, and send alerts to team members."
- "This has actually lessened the number of incidents and errors. Engineers can now search through incidents and processes and solutions quickly. This supports the role of the engineers on a daily basis."
- **It was great to have responsibility from the beginning.**
- "I started in a small project, so had more control of what I was doing. **The freedom and support from other team members benefited me greatly."**
- ***Fact about OLX****:*
- *"OLX is hard at work making engineering operations more efficient. For instance, Giovanna, Head of Engineering Ops, has made Request for Comments an integral part of the engineering team's processes."*
- *Exercise: Think of your future internship and write a conversation between you and your classmate about it:*
- *- As a trainee what were you interested in?*
- *- State the goals*
- *- What tasks are you supposed to perform*
- *- Finally, what do you suggest*

Engineering Practice

1. Manager: What do you see as differences between manual and automated testing?

Engineer: 'I'd summarise the difference between manual and automated testing by the extent of human involvement. While people carry out manual testing without software assistance, automated testing uses tools or frameworks with no human help. So, while manual methods are useful for exploratory and randomised testing, automated testing gives you fast results free from human error. You need a qualified programmer to set up automated tests, meaning you need a specialist on your testing team'.

2. Manager: When selecting tools for your automation test, how do you decide which ones to use?

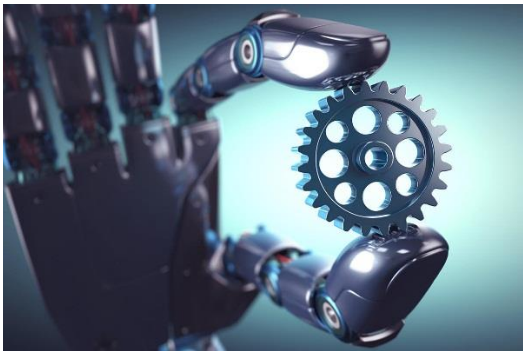
The interviewer may want to know more about your decision-making process and your knowledge of applying automation testing tools. It might be helpful to use the STAR technique, which stands for Situation, Task, Analysis and Result, to offer a specific example of how you chose a tool for a previous project. You can demonstrate your knowledge base and experience in one answer.

Engineer: 'When selecting a tool for an automation test, I have a checklist of criteria I typically use to determine which tool is most appropriate. For example, when I worked at Company X as an automation tester, some factors I considered when choosing my software testing tool included:

- the tools testing capabilities against the elements I reviewed
- the test environment specifications
- identification features for UI elements
- my budget and scope for including new tools if needed
- capacity for database testing
- debugging features
- how easy the tool was to use
- the speed of the test results

Exercise: **Test Automation Engineer Questions :**

- How would you describe the process of automation testing? ...
- What automation testing tools are you familiar with? ...
- How would you identify test cases that qualify for automation? ...
- What are the characteristics of a good software testing framework?



Experts haven’t reached an agreement on how many jobs automation will replace or create — MIT reviewed several studies that reveal the drastically conflicting predictions on job loss or gain from automation. Regardless, automation is here, and companies are embracing the technology to streamline IT, business, development and service processes. As automation increases, organizations across every industry are looking for automation engineers to help facilitate, manage and oversee enterprise automation.

The automation engineer role

Automation has been a cornerstone of the manufacturing industry for decades, but it’s relatively new to the business, healthcare and finance industries. Outside of manufacturing and factory automation, IT automation is typically focused on service automation and (quality assurance) QA testing of automated processes. The goal of an automation engineer is to eliminate defects, errors and problems with product or software development and with business or customer service processes.

Businesses are also increasingly embracing automated chatbots to help solve customer issues or to direct customers to the right person, and automation engineers help implement that technology. Automation is also used to streamline IT help desk ticketing, service management and to deliver quality products and software faster, with fewer defects. Ultimately, the goal of an automation engineer is to reduce the load on workers and to improve efficiency and reliability by streamlining manual processes that are redundant or inconsistent.

As an automation engineer, you will be expected to:

- Identify opportunities for automation within software processes.
- Design and execute (Quality Assurance) QA tests using scripts that automatically test functionality.
- Run tests for databases, systems, networks, applications, hardware and software.
- Identify bugs and quality issues in development, service or business processes.

- Install applications and databases relevant to automation.
- Collaborate with other business units to understand how automation can improve workflow.
- Gather requirements from clients, customers or end-users to develop the best automation solutions.

Curriculum Vitae

Zbigniew Kominek, MSc

PERSONAL DETAILS

Date of birth:	29.03.1982
Place of birth:	Katowice, Poland
Address:	ul.Radockiego 120/10 40-645 Katowice woj. śląskie Poland
Phone number:	(+48) 609 708 768
E-mail address:	zbigniew.kominek@gmail.com
Web site:	www.zbyhoo.xt.pl

EDUCATION

Silesian University of Technology
Gliwice, Poland
October 2001 – December 2006

Department:	Automatic Control, Electronics and Computer Science
Faculty:	Macro-faculty (Automatic Control and Robotics, Electronics and Telecommunication, Computer Science – **all courses and exams in English)**
Specialization:	Databases, Computer Networks and Systems
Master Thesis:	"3D-graphics engine based on OpenGL library having objects with physical properties"
Final Grade:	5 (very good)

Maria Skłodowska-Curie High School
Katowice, Poland
- German language specialization class

LANGUAGES

- Polish - mother
- English - fluent
- German - intermediate

MAIN TECHNICAL SKILLS

- C/C++, C#, Java, OpenGL

OTHER TECHNICAL SKILLS

- XHTML, CSS, SQL, XML, .NET Framework 2.0
- Visual Studio, Netbeans, MS Office
- Windows 95/98/Me/2000/XP, Unix-like operating systems

PROFESSIONAL EXPERIENCE

Hanslik Software Laboratory
Katowice, Poland
September 2005 – December 2005

Developing software based on JUnit for tests' automation of GIS web applications created with the help of J2EE and JavaScript. Designing documents flow management system based on web services and RDBMS for architecture department of local governments.

INTERESTS

- computer science, programming, 2D/3D computer graphics
- ancient civilizations, beginning of Christianity
- martial arts, basketball

Job Interview

Engineering interview questions

1. Tell me about the most challenging engineering project you've worked on.
2. Describe a written technical report or presentation you had to complete.
3. Explain a time you had to use logic to solve an engineering problem.
4. Describe a time you demonstrated leadership skills at work.
5. What processes do you follow to catch any mistakes in your work?
6. What engineering skills have you learned or improved upon in the past six months?
7. What software packages are you familiar with?
8. Describe a time you used problem-solving skills to figure out a design problem.
9. What strengths do you have that make you a good engineer?
10. What's your most successful engineering project?
11. How do you stay current with the latest technology?
12. Describe a time you had to work on a team and something didn't go well. What would you do differently?
13. Have you ever had an experience with a difficult client, employer, or employee? How did you handle the situation?
14. Tell me about a time you got negative feedback on your work. How did you respond?
15. Why are you interested in this role? Why are you interested in working at this company?
16. What will be the biggest challenge for you in this position?
17. Describe your ideal manager.
18. What are your salary expectations?
19. Do you have security clearance to work on classified projects?
20. Where would you like to be in your career five years from now?

Interview with Mechanical Engineer, Mark Thies

Name: Mark Thies
Current employer: Fluor Corporation
Job title: Mechanical Engineer
Science Career: Mechanical Engineer
Time working in this field: 25 years

What do you do?

Engineers solve problems. Mechanical engineers in my department at Fluor Southern California, design and purchase mechanical equipment (pumps, heat exchangers, pressure vessels, etc.) for use in large facilities such as oil refineries and power plants.

How did you become interested in this area of science/engineering?

Since high school I've enjoyed physics, math, and technical problem solving. Mechanical engineering was a great way to combine all of these interests in the pursuit of a challenging career path.

What are some of the key characteristics that are important for a person to succeed in this type of work?

You need to have an interest and aptitude in technical things. You also need to be a good problem solver, communicate well, and be flexible.

Describe a project that you have worked on that was of particular interest to you.

My first field assignment was to support a fast-track project to help re-design and re-build a carpet factory in Georgia that had been destroyed in a fire. The factory was essential for the production of special carpet that was needed for several US Olympic facilities that were under construction. We worked 24x7 on engineering and design in a warehouse across the street from the construction jobsite, and eventually moved into construction trailers on the jobsite. It was exciting to be a part of the entire project from engineering all the way through construction and start-up of the facility.

What do you enjoy most about your job?

Working with great people to solve challenging technical challenges.

Is there any advice you would give to someone interested in this field that you wish someone had given you when you were starting out?

Gain as much hands-on experience as possible (internships, projects, field assignments).

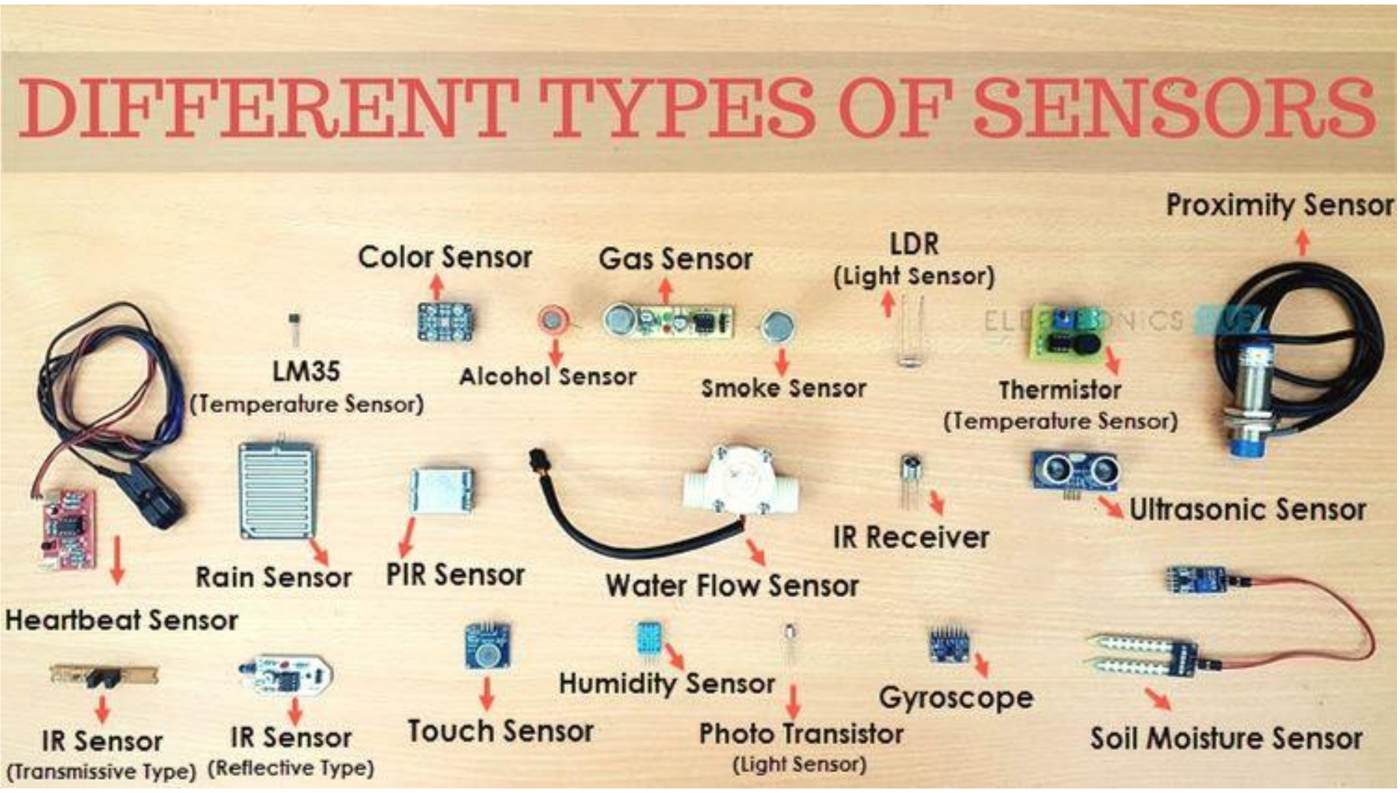
What do you enjoy doing in your free time?

I enjoy spending time with family and friends. I play sports with my wife and junior high age kids (volleyball, soccer, tennis) and play music (piano and guitar).

Unit Two: Types of Sensors

What is a sensor?

A sensor is defined as a device or a module that helps to detect any changes in physical quantity like pressure, force or electrical quantity like current or any other form of energy. After observing the changes, sensor sends the detected input to a microcontroller or microprocessor. Finally, a sensor produces a readable output signal, which can be either optical, electrical, or any form of signal that corresponds to change in input signal. In any measurement system, sensors play a major role. In fact, sensors are the first element in the block diagram of measurement system, which comes in direct contact with the variables to produce a valid output. Now you know What Sensor Actually Means? let us know some kind of its types and their applications as follow. There are several classifications of sensors made by different authors and experts. Some are very simple and some are very complex. The following classification of sensors may already be used by an expert in the subject but this is a very simple classification of sensors.



In the first classification of the sensors, they are divided in to Active and Passive. Active Sensors are those which require an external excitation signal or a power signal. Passive Sensors, on the other hand, do not require any external power signal and directly generates output response. The other type of classification is based on the means of detection used in the sensor. Some of the means of detection are Electric, Biological, Chemical, Radioactive etc. The next classification is based on conversion phenomenon i.e., the input and the output. Some of the common conversion phenomena are Photoelectric, Thermoelectric, Electrochemical, Electromagnetic, Thermo-optic, etc. The final classification of the sensors are Analog and Digital Sensors. Analog Sensors produce an analog output i.e., a continuous output signal (usually voltage but sometimes other quantities like Resistance etc.) with respect to the quantity being measured. Digital Sensors, in contrast to Analog

Sensors, work with discrete or digital data. The data in digital sensors, which is used for conversion and transmission, is digital in nature.

<u>Terminology:</u>

Temperature Sensor: measures the changes in the temperature. There are different types of Temperature Sensors such as: Thermistors, Thermocouples, RTD (Resistive Temperature Devices), etc. It can be analog or digital. In an Analog Temperature Sensor, the changes in the Temperature correspond to change in its physical property like resistance or voltage. Coming to the Digital Temperature Sensor, the output is a discrete digital value (usually, some numerical data after converting analog value to digital value). Temperature Sensors are used everywhere like computers, mobile phones, automobiles, air conditioning systems, industries etc

Proximity Sensor: is a non-contact type sensor that detects the presence of an object. It can be implemented using different techniques like Optical (like Infrared or Laser), Sound (Ultrasonic), Magnetic (Hall Effect), Capacitive, etc. Some of the applications of Proximity Sensors are Mobile Phones, Cars (Parking Sensors), industries (object alignment), Ground Proximity in Aircrafts, etc.

Infrared Sensor (IR Sensor): is a light based sensor that is used in various applications like Proximity and Object Detection. IR Sensors are used as proximity sensors in almost all mobile phones. There are two types of Infrared or IR Sensors: Transmissive Type and Reflective Type. In Transmissive Type IR Sensor, the IR Transmitter (usually an IR LED) and the IR Detector (usually a Photo Diode) are positioned facing each other so that when an object passes between them, the sensor detects the object. The other type of IR Sensor is a Reflective Type IR Sensor. In this, the transmitter and the detector are positioned adjacent to each other facing the object. When an object comes in front of the sensor, the infrared light from the IR Transmitter is reflected from the object and is detected by the IR Receiver and thus the sensor detects the object.

Ultrasonic Sensor: is a non-contact type device that can be used to measure distance as well as velocity of an object. An Ultrasonic Sensor works based on the properties of the sound waves with frequency greater than that of the human audible range. Using the time of flight of the sound wave, an Ultrasonic Sensor can measure the distance of the object (similar to SONAR). The Doppler Shift property of the sound wave is used to measure the velocity of an object.

Light Sensor: Sometimes also known as Photo Sensors, Light Sensors are one of the important sensors. A simple Light Sensor available today is the Light Dependent Resistor or LDR. The property of LDR is that its resistance is inversely proportional to the intensity of the ambient light i.e., when the intensity of light increases, its resistance decreases and vise-versa. By using LDR is a circuit, we can calibrate the changes in its resistance to measure the intensity of Light. There are two other Light Sensors (or Photo Sensors) which are often used in complex electronic system design. They are Photo Diode and Photo Transistor. All these are Analog Sensors.

Smoke and Gas Sensors: One of the very useful sensors in safety related applications are Smoke and Gas Sensors. Almost all offices and industries are equipped with several smoke detectors, which detect any smoke (due to fire) and sound an alarm. Gas Sensors are more common in laboratories, large scale kitchens and industries. They can detect different gases like LPG, Propane, Butane, Methane (CH_4), etc. Now-a-days, smoke sensors (which often can detect smoke as well gas) are also installed in most homes as a safety measure.

Alcohol Sensor: it detects alcohol. Usually, alcohol sensors are used in breathalyzer devices, which determine whether a person is drunk or not. Law enforcement personnel uses breathalyzers to catch drunk-and-drive culprits.

Touch Sensor: it detect touch of a finger or a stylus. Often touch sensors are classified into Resistive and Capacitive type. Almost all modern touch sensors are of Capacitive Types as they are more accurate and have better signal to noise ratio.

Color Sensor: it is an useful device in building color sensing applications in the field of image processing, color identification, industrial object tracking etc. The TCS3200 is a simple Color Sensor, which can detect any color and output a square wave proportional to the wavelength of the detected color.

Humidity Sensor: If you see Weather Monitoring Systems, they often provide temperature as well as humidity data. So, measuring humidity is an important task in many applications and Humidity Sensors help us in achieving this. Often all humidity sensors measure relative humidity (a ratio of water content in air to maximum potential of air to hold water). Since relative humidity is dependent on temperature of air, almost all Humidity Sensors can also measure Temperature.

Tilt Sensor: Often used to detect inclination or orientation, Tilt Sensors are one of the simplest and inexpensive sensors out there. Previously, tilt sensors are made up of Mercury (and hence they are sometimes called as Mercury Switches) but most modern tilt sensors contain a roller ball.

<u>Exercise 3:</u> Fill in the gaps with the following words:

Applications, are, can, detecting, devices, include, many, otherwise, properties, sensors, such as, types.

Sensor/Detectors/Transducers (1) electrical, opto-electrical, or electronic (2) composed of specialty electronics or (3) sensitive materials, for determining if there is a presence of a particular entity or function. Many (4) of sensors, detectors, and transducers are available including those for (5) a physical presence (6) flame, metals, leaks, levels, or gas and chemicals, among others. Some are designed to sense physical (7) such as temperature, pressure, or radiation, while others (8) detect motion or proximity. They operate in a variety of manners depending on the application and may (9) electromagnetic fields, or optics, among others. Many (10) over a wide range of industries use sensors, detectors, and transducers of (11) kinds to test, measure, and control various processes and machine functions. With the advent of the Internet of Things, the need for (12) as a primary tool to provide enhanced automation is increasing.

Grammar:

Tense or Modal + Base	Active Voice	Passive Voice
Simple Present	beat / beats	am/is/are beaten
Past	beat	was /were beaten
Future	shall/will beat	shall /will be beaten
Continuous		
Present	am/is/are beating	am/is/are being beaten
Past	was/were beating	was/were being beaten
Future	shall/will be beating	Not applicable
Perfect		
Present	have/has beaten	have/has been beaten
Past	had beaten	had been beaten
Future	shall/will have beaten	shall/will have been beaten
Perfect Continuous		
Present		
Past	Not applicable	Not applicable
Future		
Can/may/must, etc + base	can/may/must, etc beat	can/may/must, etc be beaten.

Practice:

Fill in the correct passive form of the verb in parentheses.

1. After the earthquake, aid was sent to the people of Haiti. (sent)
2. The electricity was cut off because the bill hadn’t been paid. (not pay)

1. Penicillin ______ by Alexander Fleming in 1928. (discover)
2. Statements ______ from all the witnesses at this moment. (take)
3. Whales ______ by an international ban on whaling. (must protect)
4. Both weddings _______ by Good Taste. (cater)
5. A Picasso ____ from the Metropolitan Museum of Art.(steal)
6. ____ this washing machine ______in Germany? (make)
7. Tea _____ in China. (grow)
8. When we reached the airport, we found that all the flights____ due to the storm. (cancel)
9. The fax _____ until tomorrow morning. (not send)
10. The soundtrack of a movie _____ always _____ after the filming is finished. (is/add)

Answers:

1. was discovered
2. are being taken
3. must be protected
4. were catered
5. was stolen
6. Was/made
7. is grown
8. had been cancelled
9. won’t be sent
10. is/added

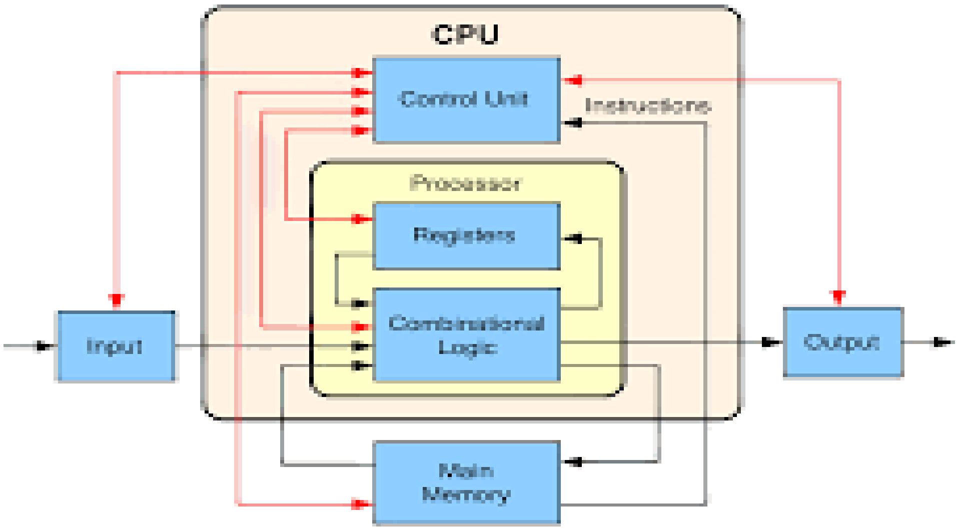
Sentences In Passive Voice: Transform into the active voice:

1. The school was struck by lightning.
2. This morning the burglar was arrested by the police.
3. One type of air pollution is caused by hydrocarbons.
4. An elaborate supper for the miners was prepared by Mr. Patel and his children.
5. The cookies were stolen by the Mad Hatter.
6. New York City's Central Park was designed in 1857 by F.L. Olmsted and Calbert Vaux.

7. It was decided by the court that the contract was invalid.
8. The first commercially successful portable vacuum cleaner was invented by a janitor who was allergic to dust.
9. After Leonardo da Vinci's death, the *Mona Lisa* was purchased by King Francis I of France.
10. The allegorical novel *Animal Farm* was written by British author George Orwell during World War II.

UNIT_3: Central processing unit (CPU)

A central processing unit (CPU), is the electronic circuitry that executes instructions comprising a computer program. The CPU performs basic arithmetic, logic, controlling, and input/output (I/O) operations specified by the instructions in the program. This contrasts with external components such as main memory and I/O circuitry, and specialized processors such as graphics processing units (GPUs). Principal components of a CPU include the arithmetic logic unit (ALU) that performs arithmetic and logic operations, processor registers that supply operands to the ALU and store the results of ALU operations, and a control unit that orchestrates the fetching, decoding and execution of instructions by directing the coordinated operations of the ALU, registers and other components.



The fundamental operation of most CPUs is to execute a sequence of stored instructions that is called a program. The instructions to be executed are kept in some kind of computer memory. Nearly all CPUs follow the fetch, decode and execute steps in their operation, which are collectively known as the instruction cycle. After the execution of an instruction, the entire process repeats, with the next instruction cycle normally fetching the next-in-sequence instruction because of the incremented value in the program counter. If a jump instruction was executed, the program counter will be modified to contain the address of the instruction that was jumped to and program execution continues normally. In more complex CPUs, multiple instructions can be fetched, decoded and executed simultaneously. Some instructions manipulate the program counter rather than producing result data directly; such instructions are generally called "jumps" and facilitate program behavior like loops, conditional program execution, and existence of functions. In some processors, some other instructions change the state of bits in a "flags" register. These flags can be used to influence how a program behaves, since they often indicate the outcome of various operations.

Terminology:

Electronic circuit: is composed of individual electronic components, such as resistors, transistors, capacitors, inductors and diodes, connected by conductive wires or traces through which electric current can flow. The combination of components and wires allows various simple and complex operations to be performed: signals can be amplified, computations can be performed, and data can be moved from one place to another.

Input/output: is the communication between an information processing system, such as a computer, and the outside world, possibly a human or another information processing system. Inputs are the signals or data received by the system and outputs are the signals or data sent from it.

Memory: is a device or system that is used to store information for immediate use in a computer or related computer hardware and digital electronic devices.

Graphics Processing Unit (GPU): is a specialized electronic circuit designed to rapidly manipulate and alter memory to accelerate the creation of images in a frame buffer intended for output to a display device.

Arithmetic Logic Unit (ALU): is a fundamental building block of many types of computing circuits, including the CPU of computers, and GPUs. The inputs to an ALU are the data to be operated on, called operands, and a code indicating the operation to be performed; the ALU's output is the result of the performed operation.

Processor register: usually consists of a small amount of fast storage, although some registers have specific hardware functions, and may be read-only or write-only. In computer architecture, registers are typically addressed by mechanisms other than main memory, but may in some cases be assigned a memory address.

Control Unit (CU): is a component of a computer's central processing unit (CPU) that directs the operation of the processor. A CU typically uses a binary decoder to convert coded instructions into timing and control signals that direct the operation of the other units (memory, ALU and input/output devices, etc.).

Instruction cycle: is the cycle that the (CPU) follows from boot-up until the computer has shut down in order to process instructions. It is composed of three main stages: the fetch stage, the decode stage, and the execute stage.

- Fetch: The first step, fetch, involves retrieving an instruction (which is represented by a number or sequence of numbers) from program memory. The instruction's location (address) in program memory is determined by the program counter (PC), which stores a number that identifies the address of the next instruction to be fetched. After an instruction is fetched, the PC is incremented by the length of the instruction so that it will contain the address of the next instruction in the sequence. Often, the instruction to be fetched must be retrieved from relatively slow memory, causing the CPU to stall while waiting for the instruction to be returned. This issue is largely addressed in modern processors by caches and pipeline architectures

Decode: The instruction that the CPU fetches from memory determines what the CPU will do. In the decode step, performed by binary decoder circuitry known as the instruction decoder, the instruction is converted into signals that control other parts of the CPU. The way in which the instruction is interpreted is defined by the CPU's instruction set architecture (ISA). [e] Often, one group of bits (that is, a "field") within the instruction, called the opcode, indicates which operation is to be performed, while the remaining fields usually provide supplemental information required for the operation, such as the operands. Those operands may be specified as a constant value (called an immediate value), or as the location of a value that may be a processor register or a memory address, as determined by some addressing mode.

- Execute: After the fetch and decode steps, the execute step is performed. Depending on the CPU architecture, this may consist of a single action or a sequence of actions. During each action, control signals electrically enable or disable various parts of the CPU so they can perform all or part of the desired operation. The action is then completed, typically in response to a clock pulse. Very often the results are written to an internal CPU register for quick access by subsequent instructions. In other cases, results may be written to slower, but less expensive and higher capacity main memory. Program Counter (PC), commonly called the instruction pointer (IP), and sometimes called the instruction address register (IAR), is a processor register that indicates where a computer is in its program sequence. Usually, the PC is incremented after fetching an instruction, and holds the memory address of ("points to") the next instruction that would be executed.

Status Register, Flag Register, or Condition Code Register (CCR): is a collection of status flag bits for a processor. The status register is a hardware register that contains information about the state of the processor. Individual bits are implicitly or explicitly read and/or written by the machine code instructions executing on the processor. The status register lets an instruction take action contingent on the outcome of a previous instruction.

Loop: is a sequence of statements which is specified once but which may be carried out several times in succession. The code "inside" the loop is obeyed a specified number of times, or once for each of a collection of items, or until some condition is met, or indefinitely.

Addressing modes: are an aspect of the instruction set architecture in most central processing unit (CPU) designs. The various addressing modes that are defined in a given instruction set architecture define how the machine language instructions in that architecture identify the operand(s) of each instruction. An addressing mode specifies how to calculate the effective memory address of an operand by using information held in registers and/or constants contained within a machine instruction or elsewhere.

Pipelining: attempts to keep every part of the processor busy with some instruction by dividing incoming instructions into a series of sequential steps performed by different processor units with different parts of instructions processed in parallel.

Exercise 1: (Comprehension of the text)

1. What can the UAL do in the CPU?

2. What are the external components of the CPU?

3. How the program counter will be modified to contain the address of the instruction that has been jumped?

4. Give the synonyms of: treatment, type, retrieving, skip.

5. Give the opposites of: seldom, complicate, before, finishes.

Exercise 3: Fill in the gaps with the following words:

also, bits, example, executing, flags, memory, operations, program, register, specified, status, terminated, well, zero.

Typically, flags in the status (1) are modified as effects of arithmetic and bit manipulation (2) . For example, a Z bit may be set if the result of the operation is (3) and cleared if it is nonzero. Other classes of instructions may (4) modify the flags to indicate (5) . For (6) , a string instruction may do so to indicate whether the instruction (7) because it found a match/mismatch or because it found the end of the string. The (8) are read by a subsequent conditional instruction so that the (9) action (depending on the processor, a jump, call, return, or so on) occurs only if the flags (10) a specified result of the earlier instruction. A status register may often have other fields as (11) , such as more specialized flags, interrupt enable (12) , and similar types of information. During an interrupt, the status of the thread currently (13) can be preserved (and later recalled) by storing the current value of the status register along with the (14) counter and other active registers into the machine stack or some other reserved area of (15) .

A Dialogue between Teacher and Student about Science: 1

Sam is a student of the science division in his school. He has a huge interest in science and now he is talking about this topic with his science teacher Mr. Mehta. Let’s take a look at this interesting conversation.

Teacher: Good morning, Sam. How are you?

Sam: Good morning, Sir. I am fine. What about you?

Teacher: I am fine. So do you know about modern science?

Sam: Sir as a student of science division, I study a lot about modern science. But I think, I can learn more from you. can we talk about that?

Teacher: Yeah, of course, we can. I think everyone should talk about modern science and its invention.

Sam: Sir, I have a question. What is the biggest invention of modern science?

Teacher: I am sure, the answer is Computer. But different people can answer different things from their own view and perception. But the computer made the biggest impact on human life and I think till now it's the biggest and the best invention of modern science.

Sam: I agree with you. The computer has changed lots of things.

Teacher: Yeah, especially the entire education system has changed. Now students can study on the internet and they don't even need a physical tutor. There are lots of websites where you will find free courses.

Sam: What else changes have come to our life due to the invention of the computer?

Teacher: The entire communication system has changed. Now you can get connected with anyone anywhere in the world within a couple of seconds with a Skype or Facebook call. As you can assume, this is huge for us.

Sam: What are the advantages of this?

Teacher: Lots of advantages are there. Mainly I think people can share their cultures and people become diverse. Diversity is important for a good human. Then good communication has built lots of business opportunities. Another interesting thing is the interracial relationships. That's how the entire world has been so small.

Sam: Yes, this is true. Thank you so much, sir, for this important conversation.

Teacher: You are welcome, Sam. Take care, bye for now.

Sam: Bye, sir.

Exercise: **Think of improving a given device that makes things easier and more enjoyable.**

what you dream of changing in technology - what you like about it now it is here and what you didn't like:

I would
I wish I could improve / change / develop……

TECHNICAL REPORT

- **Create an outline**. Technical reports are usually very structured, so create a draft to follow it to make your report clear and well-structured.

Here are the elements of a technical report:

- **Title page:** It contains **the title**, **the date**, **institution details**, and the like. Keep in mind, that the content of the title page is not added up to the word count of a report.

- **Introduction:** In this part, highlight **the main goals** of your paper clearly to help your readers understand the purpose you're writing for. You can also describe **the flow of your report** to let your readers know what they should expect.

- **Summary:** Write an **overview of the whole report** here. It usually includes the **results** and **conclusions.**

- **Body:** This is the main part of your report because it carries your content. Introduce the **information using small subheadings** to make the body section more presentable and clear, so readers will be guided with these subheadings. This part can include figures and tables. (Use numbers and divide in sections)

- **Conclusion:** A conclusion implies **a summary** of the main points that you report in the body, what **decision** you came. Use words to show that you are concluding your work to prepare readers that you're about to finish. The conclusion should be **short and concise**. But the main idea is to cover every question that a reader may ask.

- **Appendices:** In this section, you should include graphs or diagrams but if you don’t have any materials, just skip the section. (Needed Details).