ELECTRONICS & COMMUNICATION ENGINEERING

TECH CONNECT

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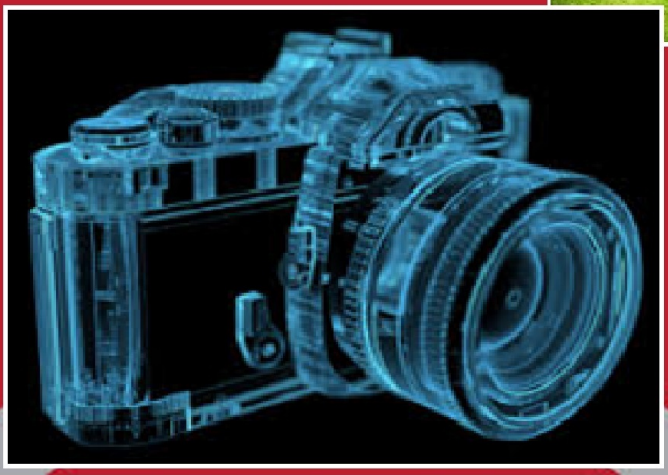

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1.Sixth Sense Technology

It's the beginning of a new era of technology where engineering will reach new milestones. Just like in the science fiction movies where display of computer screen appears on walls, commands are given by gestures, the smart digital environment which talks to us to do our work and so on, these all will be possible very soon. You imagine it and sixth sense technology will make it possible. Isn't it futuristic? Now it's time for sci-fi movie directors to think ahead because the technology shown in there fiction movies soon will become household stuff. Before few years back it was considered to be supernatural or tantalizing imagination. But now it has been made possible. Thanks to Pranav Mistry, a genius who introduced mankind to this futuristic technology.

Fig. 1: A Representational Image of Sixth Sense Technology

Sixth Sense

Sixth Sense is a wearable gestural interface that enhances the physical world around us with digital information and lets us use natural hand gestures to interact with that information. It is based on the concepts of augmented reality and has well implemented the perceptions of it. Sixth sense technology has integrated the real world objects with digital world. The fabulous 6th sense technology is a blend of many exquisite technologies. The thing which makes it magnificent is the marvelous integration of all those technologies and presents it into a single portable and economical product. It associates technologies like hand gesture recognition, image capturing, processing, and manipulation, etc. It superimposes the digital world on the real world.

Sixth sense technology is a perception of augmented reality concept. Like senses enable us to perceive information about the environment in different ways it also aims at perceiving information. Sixth sense is in fact, about comprehending information more than our available senses. And today there is not just this physical world from where we get information but also the digital world which has become a part of our life. This digital world is now as important to us as this physical world. And with the internet the digital world can be expanded many times the physical world. God hasn't given us sense to interact with the digital world so we have created them like smart phones, tablets, computers, laptops, net books, PDAs, music players, and others gadgets. These gadgets enable us to communicate with the digital world around us.

But we're humans and our physical body isn't meant for digital world so we can't interact directly to the digital world. For instance we press keys to dial a number; we type text to search it and so on. This means for an individual to communicate with the digital world he/she must learn it. We don't communicate directly and efficiently to the digital world as we do with the real world. The sixth sense technology is all about interacting to the digital world in most efficient and direct way. Hence, it wouldn't be wrong to conclude sixth sense technology as gateway between digital and real world. Before Wear Ur World (WuW) came there were other methods like speech recognition software, touch recognition etc., which empowered us with direct interfacing.

This WuW or sixth sense device invented by Pranav Mistry is a prototype of next level of digital to real world interfacing. It comprises of a camera, a projector, a mobile cum computing device and colored sensors which are put on the fingers of a human being. The device efficiently senses the motion of the colored markers. Using them it provides us the freedom of directly interacting with the digital world. This technology enables people to interact in the digital world as if they are interacting in the real world.

Need for sixth Sense

Humans take decisions after acquiring inputs from the senses. But the information we collect aren't enough to result in the right decisions. But the information which could help making a good decision is largely available on internet. Although the information can be gathered by connecting devices like computers and mobiles but they are restricted to the screen and there is no direct interaction between the tangible physical world and intangible digital world. This sixth sense technology provides us with the freedom of interacting with the digital world with hand gestures. This technology has a wide

application in the field of artificial intelligence. This methodology can aid in synthesis of bots that will be able to interact with humans.

Working of sixth sense

The sixth sense technology uses different technologies like gesture recognition, image processing, etc. At present the commercial product isn't launched but the prototype is prepared. The sixth sense prototype is made using very common and easily available equipments like pocket projector, a mirror, mobile components, color markers and a camera.

Fig. 2: Image Showing Sixth Sense Technology Prototype Equipped With Pocket Projector, Mobile Components, Mirror, Color Markers, and Camera

The projector projects visual images on a surface. This surface can be wall, table, book or even your hand. Thus, the entire world is available on your screen now. When user moves their hands to form different movements with colored markers on the finger tips, the camera captures these movements. Both the projector and the camera are connected to the mobile computing device in the user's pocket. Recognition is made using computer vision technique. These markers act as visual tracking fiducials. The software program processes this video stream data and interprets the movements into gestures. The gestures are different from one another and are assigned some commands. These gestures can act as input to application which is projected by the projector. Since, the projector is aligned downwards for compactness; therefore images would be formed at the user's feet if mirror wasn't used. The mirror reflects the image formed by the projector to front. The entire hardware is fabricated in the form of a pendent. The entire product cost around $ 350 and that also because of projector. It works very similar like a touch screen phone with entire world as the screen.

Evolution of Sixth Sense Technology

Steve Mann is considered as the father of Sixth Sense technology who made a wearable computer in 1990. He implemented the Sixth Sense technology as the neck worn projector with a camera system. He was a media lab student at that time. Then his work was carried forward by Pranav Mistry, an Indian research assistant in MIT Media Lab. He came up with exciting new applications from this technology. Sixth sense technology was developed at media labs in MIT and coined as Wear Ur World (WUW). The inventors have filed patent under the name Wear Ur World (WUW) in February 2010.

Fig. 3: Image Showing Pranav Mistry Introducing New Applications from Sixth Sense Technology

Applications

1.Fingers as brush: The user can draw anything on paint with the help of his fingers. This drawing can be 3D also. Hence, no need to use mouse.

Fig. 4: Image Showing User Capturing Photo Using Fingers with Sixth Sense Technology

2.Capture photos with fingers: using the fingers the user can capture photos hence, no need to carry an additional gizmo. The box created by the fingers act as frame for capturing photo.

3.Palm is the new dialer: this technology enables the user to callwithout using the dialer. The dialer will be projected on palm and the user can dial the number using other hand.

Fig. 5: Image Showing Dialer Projected on Palm to Make Calls Using Sixth Sense Technology

4.Read Books easily: Check out the ratings of the Book you are going to buy, it checks the ratings from the internet. And another amazing thing is that it reads the book for you.

5.Video Newspapers: like the video newspapers of Harry Potter this technology identifies the news headline and then projects the relevant video.

6.Check your Flight Status: Just place the ticket in front of the projector and it checks its status from the internet.

7.Clock: the user just needs to make gesture of clock and the watch will be projected on the user's hand.

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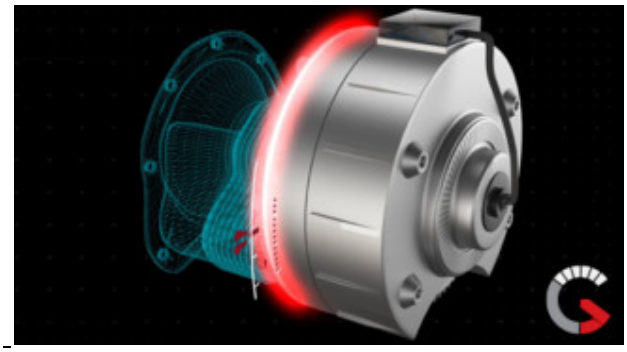
2.3D imaging

3D imaging is a technique to develop or create the illusion of depth in an image. 3D imaging has become a very useful factor for industrial applications to assist in quality control processes.3D imaging is the process of manipulating 2D data into three dimensional format, creating the illusion of depth. Many different technologies are able to assist with this process, in order to develop a 3D rendering for inspection and testing purposes.



Common types of industrial 3D imaging

- **3D Structured Light** – Structured light is the process of using a focused white or colored light which is then picked up by a specialized camera and read into a program to capture external features of an object which is then turned into a polygon based surface.
- **3D laser imaging** – also known as 3D laser scanning, 3D laser imaging is the process of capturing data using laser beams which are exposed to the surface of an object. The captured data develops a 3D rendering with the assistance of a software.
- **CT imaging** – Computed Tomography (CT) imaging is a radiographic testing technique, utilizing an x-ray source to penetrate through materials and capturing 2D x-ray tomography slices at pre-determined increments for an object that is

rotating 360 degrees. As the object rotates and 2D x-ray images are captured, a specialized software is used to reconstruct the 2D images and develop a 3D rendering of the object, which is available for further internal and external part analysis.

- **3D x-ray imaging** – 3D x-ray is the process of capturing 2D x-ray images from different angles of an object, which can be used to reconstruct and create the illusion of depth. For the purpose of 3D x-ray, these 2D x-ray images are viewed and analyzed independently to focus on certain areas of an object.

Working of 3 D Imaging

3D imaging relies on stereography, which we can observe from a familiar source: The human vision system. Humans see things with two eyes set slightly apart. This allows them to perceive depth in addition to the horizontal and vertical information reproduced by, for example, the standard 2D television screen.Since the eyes are separated, each one sees the world from a different angle. Rapidly covering one eye, then the other, demonstrates subtle but distinct differences in angle each time. The dimensionality that humans perceive in their vision comes from the brain combining disparate images into a whole – a phenomenon called parallax.

Two lenses are used in every 3D shot – each captures an image slightly offset from the other. As a result, 3D images contain twice as much information as 2D ones. The images are edited to display while maintaining full data fidelity. The eye cannot process both sets of images on its own: Each eye processes its own set of images.

The left-hand and right-hand images combine in the brain to reproduce the sense of depth.

3D imaging can be used for a wide range of applications – analyzing, measuring, and positioning parts are among the most important. To get the best results possible, however, it's crucial to design a system with the necessary performance and environmental constraints in mind.

3D imaging can be achieved through active or passive methods. Active systems use methods like time-of-flight, structured light, and interferometry, which generally require a high degree of control in the filming environment. Passive methods include depth from focus and light field.

In snapshot-based methods, the difference between two snapshots captured at the same time is used to calculate the distance to objects – this is called passive stereo imaging. It can be achieved by moving a single camera, but using two cameras with identical specifications is more efficient.

By contrast, active snapshot methods can incorporate additional technologies that interpret visual data. Active snapshots might use time-of-flight, encoding 3D data into each pixel by measuring the time that elapses as light travels to the target object and then returns to a sensor.

Another successful method for producing 3D shape data is laser triangulation. In laser triangulation, a single camera is used to derive height variations from laser patterns projected onto the surface of an object, then observes how those patterns move when viewed from an angle with a camera. Even with a single camera and without triangulation, perception of object distance is still possible by observing how the object scales as it moves near or far from a camera.

Applications

3D imaging has multiple uses for industrial applications, regardless of industry and type of part being inspected. The purpose of a 3D image is to provide users with a realistic replica of the object for quality control purposes. Some of the most common applications for 3D imaging across the aerospace, automotive and medical device industry include:

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~GopiUjwalaDevi(18761A0475)

3.Thermal copper pillar bump

The thermal copper pillar bump, also known as the "thermal bump", is a thermoelectric device made from thin-film thermoelectric material embedded in flip chip interconnects (in particular copper pillar solder bumps) for use in electronics and optoelectronic packaging, including: flip chip packaging of CPU and GPU integrated circuits (chips), laser diodes, and semiconductor optical amplifiers (SOA). Unlike conventional solder bumps that provide an electrical path and a mechanical connection to the package, thermal bumps act as solid-state heat pumps and add thermal management functionality locally on the surface of a chip or to another electrical component. The diameter of a thermal bump is 238 μm and 60 μm high.

The thermal bump uses the thermoelectric effect, which is the direct conversion of temperature differences to electric voltage and vice versa. Simply put, a thermoelectric device creates a voltage when there is a different temperature on each side, or when a voltage is applied to it, it creates a temperature difference. This effect can be used to generate electricity, to measure temperature, to cool objects, or to heat them.

For each bump, thermoelectric cooling (TEC) occurs when a current is passed through the bump. The thermal bump pulls heat from one side of the device and transfers it to the other as current is passed through the material. This is known as the Peltier effect. The direction of heating and cooling is determined by the direction of current flow and the sign of the majority electrical carrier in the thermoelectric material. Thermoelectric power generation (TEG) on the other hand occurs when the thermal bump is subjected to a temperature gradient (i.e., the top is hotter than the bottom). In this instance, the device generates current, converting heat into electrical power. This is termed the Seebeck effect.

The thermal bump was developed by Nextreme Thermal Solutions as a method for integrating active thermal management functionality at the chip level in the same manner that transistors, resistors and capacitors are integrated in conventional circuit designs today. Nextreme chose the copper pillar bump as an integration strategy due to its widespread acceptance by Intel, Amkor and other industry leaders as the method for connecting microprocessors and other advanced electronics devices to various surfaces during a process referred to as “flip-chip” packaging. The thermal bump can be integrated as a part of the standard flip-chip process or integrated as discrete devices.

The efficiency of a thermoelectric device is measured by the heat moved (or pumped) divided by the amount of electrical power supplied to move this heat. This ratio is termed the coefficient of performance or COP and is a measured characteristic of a thermoelectric device. The COP is inversely related to the temperature difference that the device produces. As you move a cooling device further away from the heat source, parasitic losses between the cooler and the heat source necessitate additional cooling power: the further the distance between source and cooler, the more cooling is required. For this reason, the cooling of electronic devices is most efficient when it occurs closest to the source of the heat generation.

Use of the thermal bump does not displace system level cooling, which is still needed to move heat out of the system; rather it introduces a fundamentally new methodology for achieving temperature uniformity at the chip and board level. In this manner, overall thermal management of the system becomes more efficient. In addition, while conventional cooling solutions scale with the size of the system (bigger fans for bigger systems, etc.), the thermal bump can scale at the chip level by using more .

Applications

Thermal bumps can be used in a number of different ways to provide chip cooling and power generation.

General cooling

Thermal bumps can be evenly distributed across the surface of a chip to provide a uniform cooling effect. In this case, the thermal bumps may be interspersed with standard bumps that are used for signal, power and ground. This allows the thermal bumps to be placed directly under the active circuitry of the chip for maximum effectiveness. The number and density of thermal bumps are based on the heat load from the chip. Each P/N couple can provide a specific heat pumping (Q) at a specific temperature differential (ΔT) at a given electric current. Temperature sensors on the chip ("on board" sensors) can provide direct measurement of the thermal bump performance and provide feedback to the driver circuit.

Precision temperature control

Since thermal bumps can either cool or heat the chip depending on the current direction, they can be used to provide precision control of temperature for chips that must

operate within specific temperature ranges irrespective of ambient conditions. For example, this is a common problem for many optoelectronic components.

Hotspot cooling

In microprocessors, graphics processors and other high-end chips, hotspots can occur as power densities vary significantly across a chip.[4] These hotspots can severely limit the performance of the devices. Because of the small size of the thermal bumps and the relatively high density at which they can be placed on the active surface of the chip, these structures are ideally suited for cooling hotspots. In such a case, the distribution of the thermal bumps may not need to be even. Rather, the thermal bumps would be concentrated in the area of the hotspot while areas of lower heat density would have fewer thermal bumps per unit area. In this way, cooling from the thermal bumps is applied only where needed, thereby reducing the added power necessary to drive the cooling and reducing the general thermal overhead on the system.

Power generation

In addition to chip cooling, thermal bumps can also be applied to high heat-flux interconnects to provide a constant, steady source of power for energy scavenging applications. Such a source of power, typically in the mW range, can trickle charge batteries for wireless sensor networks and other battery operated systems.

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4. Global Warming

Global warming is the long-term rise in the average temperature of the Earth's climate system. It is a major aspect of climate change and has been demonstrated by direct temperature measurements and by measurements of various effects of the warming. Global warming and climate change are often used interchangeably. But, more accurately, global warming is the mainly human-caused increase in global surface temperatures and its projected continuation, while climate change includes both global warming and its effects, such as changes in precipitation.[11] While there have been prehistoric periods of global warming,observed changes since the mid-20th century have been unprecedented in rate and scale.

The effects of global warming are already bringing harm to human communities and the natural world. Further temperature rises will have a devastating impact and more action on greenhouse gas emissions is urgently required.Population and climate change are inextricably linked. Every additional person increases carbon emissions — the rich far more than the poor — and increases the number of climate change victims – the poor far more than the rich.

Population growth is also important because it affects the Earth's ability to withstand climate change and absorb emissions, such as through deforestation as land is converted for agricultural use to feed a growing human population.We are currently adding more than 80 million people a year to our global population. The UN projects that without further action to address population growth, there will be two billion more people by 2050, and three-and-a-half billion more by 2100.

Predicting the consequences of global warming is one of the most difficult tasks faced by the climate researchers. This is due to the fact that natural processes that cause rain, snowfall, hailstorms, rise in sea levels is reliant on many diverse factors. Moreover, it is very hard to predict the size of emissions of greenhouse gases in the future years as this is determined majorly through technological advancements and political decisions. Global warming produces many negative effects some of which are described here. Firstly, extra water vapour which is present in the atmosphere falls again as rain which leads to floods in various regions of the world. When the weather turns warmer, evaporation process from both land and sea rises. This leads to drought in

the regions where increased evaporation process is not compensated by increased precipitation.

In some areas of the world, this will result in crop failure and famine particularly in areas where the temperatures are already high. The extra water vapour content in the atmosphere will fall again as extra rain hence causing flood. Towns and villages which are dependent on the melting water from snowy mountains may suffer drought and scarcity of water supply. It is because the glaciers all over the world are shrinking at a very rapid rate and melting of ice appears to be faster than previously projected. According to Intergovernmental Panel on Climate Change (IPCC), about one-sixth of the total population of the world lives in the regions which shall be affected by a decrease in melting water. The warmer climate will likely cause more heat waves, more violent rainfall and also amplification in the severity of hailstorms and thunderstorms. Rising of sea levels is the most deadly effect of global warming, the rise in temperature is causing the ice and glaciers to melt rapidly. This will lead to rise of waterlevels in oceans, rivers and lakes that can pilot devastation in the form of floods

THE CLIMATE CHANGE THREAT

Further warming of our atmosphere is now almost impossible to avoid. The effects of that warming will depend on how high and how fast the temperature rises. Global warming changes weather patterns, causing severe weather events, heatwaves, droughts and floods.Climate change is already shrinking glaciers and ice caps, altering the availability of fresh water. It contributes to ocean acidification, destroying coral reefs and other aquatic ecosystems. It makes places uninhabitable for some plants and animals, leading to extinctions and redistribution of species, threatening food production with alien pests and diseases.

Its potential human cost is catastrophic. A rise in sea levels threatens hundreds of millions of people in coastal communities and cities across the globe. Food and water shortages and conflict over productive land will arise, while progress in global health could be rolled back by communicable diseases such as malaria reaching places they never existed before. Hundreds of millions of people are likely to be forced to migrate from their homes by 2050.

CLIMATE CHANGE ACTION

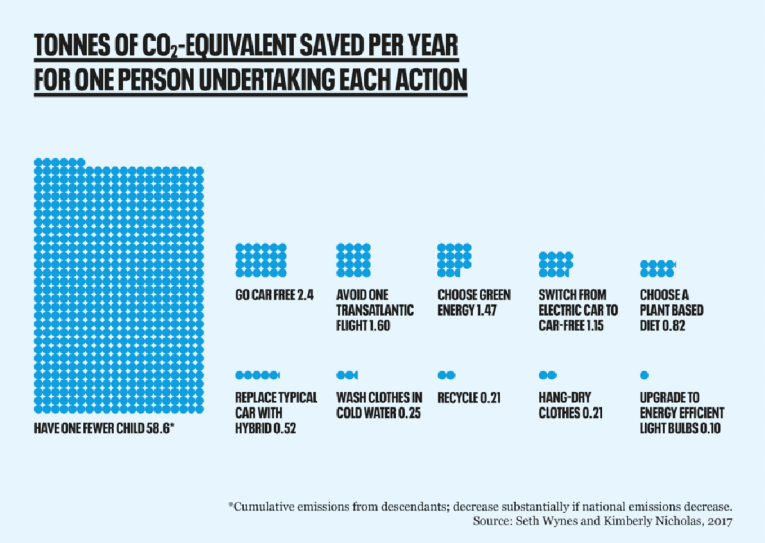
There are multiple drivers of climate change, amongst which population is only one. Overwhelmingly, emissions are produced by people in the richest countries, and industrial development and consumption patterns in the Global North are primarily responsible for the crisis we are in today. Technological solutions, personal lifestyle changes, policies to end fossil fuel use and develop alternative energy and potentially fundamental changes to our economic systems are all vital, especially as the timescale for preventing catastrophic climate change is so short - now less than a decade, according to the IPCC.

Whatever other changes we make, however, their positive impacts will be reduced and may even be completely cancelled out by adding emissions from hundreds of millions of new people as our population increases. Meanwhile, solutions such as reforestation may be more difficult to implement with more people needing food and land.Reducing the number of people being born is not a panacea for climate change, but it cuts future carbon emissions, effectively, simply and permanently, and it boosts the effectiveness of other solutions.

INDIVIDUAL ACTIONS

A study published in 2017 by the Universities of Lund and British Columbia suggested that the single most effective measure an individual in the developed world could take to cut their carbon emissions over the long term could be to have one fewer child. The study relied on estimates of future per capita climate emissions which are likely to change significantly, so it must be treated with caution. Illustrative figures produced by

the authors suggested, however, that it could be significantly more effective than any other method in saving climate emissions. All the benefits of this action are not immediate and it does not mean that we should not take other actions to cut our individual carbon footprints, of course.



GLOBAL POLICY

The 2019 *Scientist's Warning of a Climate Emergency,* signed by more than 13,000 scientists from around the world, explicitly calls for "bold and drastic transformations" regarding both economic and population policies, including making family planning services available to all and achieving full gender equity.

Another major international study in 2017 identified practical policy measures that could be taken to minimise greenhouse gas emissions as quickly as possible. Project Drawdown analysed more than eighty policy options, such as plant-based diets, solar farms and electric vehicles.

The study identified family planning and educating girls as among the top 10 workable solutions to combat climate change available today. It found that together, they would reduce CO2 emissions by 103 Gigatons by 2050 — more than onshore and offshore wind power combined.Their enormous positive effect is a result of their proven effectiveness in reducing family size and population growth.

5.Home automation using node MCU based on IOT

Automation is the technology by which a process or procedure is performed with minimal human assistance. Automation or automatic control is the use of various control systems for operating equipment such as machinery, processes in factories, boilers and heat treating ovens, switching on telephone networks, steering and stabilization of ships, aircraft and other applications and vehicles with minimal or reduced human intervention.

Automation covers applications ranging from a household thermostat controlling a boiler, to a large industrial control system with tens of thousands of input measurements and output control signals. In control complexity, it can range from simple on-off control to multi-variable high-level algorithms.

In the simplest type of an automatic control loop, a controller compares a measured value of a process with a desired set value, and processes the resulting error signal to change some input to the process, in such a way that the process stays at its set point despite disturbances. This closed-loop control is an application of negative feedback to a system. The mathematical basis of control theory was begun in the 18th century and advanced rapidly in the 20th.

Automation has been achieved by various means including mechanical, hydraulic, pneumatic, electrical, electronic devices and computers, usually in combination. Complicated systems, such as modern factories, airplanes and ships typically use all these combined techniques. The benefit of automation includes labor savings, savings in electricity costs, savings in material costs, and improvements to quality, accuracy, and precision.

Home automation or domoticsis building automation for a home, called a smart home or smart house. A home automation system will control lighting, climate, entertainment systems, and appliances. It may also include home security such as access control and alarm systems. When connected with the Internet, home devices are an important constituent of the Internet of Things ("IoT").A home automation system typically connects controlled devices to a central hub or "gateway". The user interface for control of the system uses either wall-mounted terminals, tablet or desktop computers, a mobile phone application, or a Web interface, that may also be accessible off-site through the Internet.

Home automation suffers from platform fragmentation and lack of technical standards a situation where the variety of home automation devices, in terms of both hardware variations and differences in the software running on them, makes the task of developing applications that work consistently between different inconsistent technology ecosystems hard. Customers may hesitate to bet their IoT future on proprietary software or hardware devices that use proprietary protocols that may fade or become difficult to customize and interconnect.

The nature of home automation devices can also be a problem for security, since patches to bugs found in the core operating system often do not reach users of older and lower-price devices. One set of researchers say that the failure of vendors to support older devices with patches and updates leaves more than 87% of active devices vulnerable.

Perhaps the most cited advantage of automation in industry is that it is associated with faster production and cheaper laboUr costs. Another benefit could be that it replaces hard, physical, or monotonous work. Additionally, tasks that take place in hazardous environments or that are otherwise beyond human capabilities can be done by machines, as machines can operate even under extreme temperatures or in atmospheres that are radioactive or toxic. They can also be maintained with simple quality checks. However, at the time being, not all tasks can be automated, and some tasks are more expensive to automate than others. Initial costs of installing the machinery in factory settings are high, and failure to maintain a system could result in the loss of the product itself. Moreover, some studies seem to indicate that industrial automation could impose ill effects beyond operational concerns, including worker displacement due to systemic loss of employment and compounded environmental damage; however, these findings are both convoluted and controversial in nature, and could potentially be circumvented.

The main advantages of automation are:

- Increased throughput or productivity.
- Improved quality or increased predictability of quality.
- Improved robustness (consistency), of processes or product.
- Increased consistency of output.
- Reduced direct human labor costs and expenses.
- Installation in operations reduces cycle time.
- Can complete tasks where a high degree of accuracy is required.

- Replaces human operators in tasks that involve hard physical or monotonous work (e.g., using one forklift with a single driver instead of a team of multiple workers to lift a heavy object)
- Reduces some occupational injuries (e.g., fewer strained backs from lifting heavy objects)
- Replaces humans in tasks done in dangerous environments (i.e. fire, space, volcanoes, nuclear facilities, underwater, etc.)
- Performs tasks that are beyond human capabilities of size, weight, speed, endurance, etc.
- Reduces operation time and work handling time significantly.
- Frees up workers to take on other roles.
- Provides higher level jobs in the development, deployment, maintenance and running of the automated processes.

The main disadvantages of automation are:

- Possible security threats/vulnerability due to increased relative susceptibility for committing errors.
- Unpredictable or excessive development costs.
- High initial cost.
- Displaces workers due to job replacement.

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