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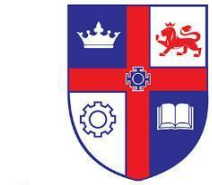

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I confirm that I understand my coursework needs to be submitted online via Google Classroom under the relevant module page before the deadline in order for my assignment to be accepted and marked. I am fully aware that late submissions will be treated as non-submission and a marks of zero will be awarded.

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Summary

Embedded system is a microprocessor-based hardware which is connected to input and output devices which is designed to conduct a specific task only. Everyone uses applications of embedded system directly or indirectly. For illustration, household appliances are the direct use of embedded system. Whereas, industrial goods are indirect use.

Now a days, embedded system is used in almost every device. This is because it effects social, technological, psychological, academical and physical aspects. For example, communication devices fulfil social aspect, transportation devices fulfil technological aspect, security devices fulfil psychological aspects, educational devices fulfil academic aspect and medical devices fulfil physical aspect.

1. Introduction

Around 98 present of microprocessor uses embedded system in them; Embedded system is a microprocessor-based hardware that is connected with the input and output devices and then use to perform a specific task. The application of an embedded system is used because it makes any work easier. Almost each and every device uses a microprocessor which has an embedded system in it. Among them the most commonly used products are telephones, watches, electronic calculators, TVs, and many more. Everyone dependents upon embedded system because it effects many aspects like physical, academical, social, technological and psychological.

Moreover, Embedded system is working as a bridge which connects the physical world with the technological world. In other words, embedded system helps humans to interact with machines. Every microprocessor with embedded system interacts by binary numbers; zeros and ones. And every binary number represents an ASCII code which helps in performing a task.

Now days, almost every person uses embedded system in their day-to-day life. Ether, directly or indirectly. Direct use can be seen in devices like telephones, robots, digital watches, Televisions, and many more. Whereas, embedded system is indirectly used in industrialized goods which use embedded system to make them but doesn’t need embedded system while using the product.

2. Features, Design & Specifications

2.1 Features

Embedded system is used in a microprocessor which is generally used for a single purpose; It is written in assembly language and the efficacy of those devices are high. These are the key features of embedded system.

Moreover, the device having a single purpose means the device is built for a specific task only. For example, a telephone; it is used for two-way communication over voice between two devices. But the device cannot be used to do other tasks like clicking pictures.

Similarly, the efficiency of devices with embedded system is high; This is because the device has a single work and the output will be efficient compared to non-embedded system. For illustration, a DSLR camera and a mobile phone camera; DSLR camera having embedded system. The quality of pictures clicked by a DSLR camera will be higher than of mobile phone camera.

2.2 Design

There are basically four types of embedded system. Namely, Real-time embedded system, Stand-alone embedded system, Networked Embedded system and Mobile embedded system. These embedded systems are classified based upon two factors and they are Performance and Functional requirements and Performance of micro-controllers (Jean, 2020).

Moreover, Real-time embedded system is divided into two types; Soft Real-time embedded system and Hard Real-time embedded system. The first one will give output after a specific time after the input is given. Whereas, the second one must give the output in a defined time interval. For example, Traffic lights and X-ray Machines

Similarly, Stand-alone embedded systems are the independent systems which operates by themselves; in other words, they don’t depend upon the host system. The application of these type of embedded system can be found in Microwave ovens and calculator.

Furthermore, networked embedded system are the systems which requires network connection to operate. The connection of the device and web server are connected through wire or wireless medium to provide the desired output. Some examples of networked embedded system are ATM machine and Card swipe machine.

Lastly, Mobile embedded system is the small and portable embedded system which require less resources to operate. Some of the devices using mobile embedded system are MP3 player and digital camera.

2.3 Specifications

The ability of a device to do its work can be referred to specification. The specifications of an embedded system are it works well and is less flexible. It works well because the whole system is focused to do a single task. For illustration, an actual scientific calculator is better than the calculator present in a smartphone. Many complex mathematical problems can be solved easily using a scientific calculator.

However, the device with embedded system is less flexible. The device is made for single purpose so it cannot be used for other purposes. From the example earlier, the calculator is not flexible because it cannot be used to perform other tasks like calling, tracking and many more.

3. Applications

3.1. Security and safety made possible by Embedded System,

When a person or thing is unharmed the security and safety is maintained. Embedded system has made safety and security possible by helping applications use its concepts to create a certain device which has its own use. Some examples of applications using embedded system which provide security are biometric scan, surveillance camera, ATM machines, alert system, and touch free devices.

For biometric scan, it allows the data to be unharmed, this is because only the authorized person can access them which means no body can access them without permission. These biometric scans be seen in biometric scanner door locks where finger print must be used in order to get in. These types of devices use embedded system to process. The biometric scanner inputs the scanned value to the system and the system compares the input value and the value stored in their database. If matched the person can go in or access the data which was locked.

Similarly, an ATM machine also provides safety. Only the person having the credit or debit card with its pin can access to the money stored in the bank. A similar embedded system as of biometric scan is used in those machines. There is a chip inside a card and when inserted in the ATM machine, it gives access to their account. Before accessing the money, the user needed to enter the pin code.

Moreover, surveillance cameras can provide security. These devices also use embedded system, the camera captures the live view of a certain place and then shows the live condition in a monitor. These captured videos can also be saved for future use. By this application of embedded system, a person can know what's happening around there surrounding and act accordingly.

Also, alert alarm is an application of embedded system which provides safety. The basic use of these devices is to alert someone if they are in danger. For illustration, a smoke alarm; if the smoke sensor receives some smoke the alarm is rang. When the sensor senses smoke the signal change and the system

receives the information and alert alarm in the system is triggered, which alerts the user to move to safety.

In the covid-19 pandemic where the viruses spread through contact; Embedded system's applications which are touch free had helped in the reduction of virus spread, touch free devices like water tap, soap or hand sanitizer dispenser and door have helped. These devices work when they sense something around the reserving end of the device.

3.2. Use of Embedded System in household appliance,

The use of embedded system for household appliances has made work easier for everyone. Devices like washing machine, microwave oven, digital alarm clock, refrigerator, dishwasher, DVD player are the examples of application of embedded system.

Washing machine are used to cosh clothes in an easy and effective manner; The alternative method of washing clothes is by hands. This method of washing can be very difficult so washing machine was invented to make work easier. Clothes, detergent and water are given to the machine for further cleaning process. This will save a lot of energy which can be used to do other work.

Similarly, a dishwasher has a similar washing method as of a washing machine. The main use of a dishwasher is to clean utensils. The dishwasher first sprays water from six corners, then does the same with soap and finally repeat the water spraying task. Then finally the dishes are cleaned by the help of an application of embedded system easily.

Now a days use of devices using renewable source of energy is used. An example of this is an induction cooker. This is also an application of embedded system, the copper wire inside the cooker generates magnetic field which is in direct contact with the cooking vessel. This therefore makes the vessel hot and useable to cook food.

Furthermore, microwave oven is another example of an embedded system. This device is used to heat food. For the working of this device, microwave generates waves which strikes the food which cause them to vibrate. The vibration leads to food to heat. The process of generating waves in controlled by an embedded system which takes input from users as per there requirements.

Not just heating, embedded system's application can be seen in cooling food as well. A refrigerator is the perfect example of it. The main purpose or this device is to keep food fresh. The embedded system allows cool air to circulate within the device which keeps the food cold and fresh.

Lastly, devices like digital clock and alarm are used as household appliance which is an application of embedded system. These devices make people aware about the time and if they have anything important alarm clocks can help to remind them. This device has made human beings accountable towards time management. Now a days time is very important and to get the max out of it digital clock with alarm can be used.

3.3. Use of Embedded System for Education,

Education is arguably one of the most important things in 21st century, without education a person is value less. Many applications of embedded system have affected directly or indirectly in the way of being educated. Those applications include projector or screen, calculator and router; this application can help in education if used properly.

How can a projector or screen help in education? The answer for this question is simple; projector and screen are used in classroom for presentation of course content. These devices work when connects is established with a laptop or PC via cable and the screen can be shared. This will allow a huge mass of people to see the displayed content, which leads to the conclusion of those devices helping in education.

Similarly, a router can help in education. Router is a device which allows the user to get access to the internet. The internet has information for every level and if used properly an individual can get educated. The assess of many websites which helps in education can be found. Some of those websites include Udemy, Coursera, Udacity , and Edx.

Also, router can help in virtual classes. As stated, before router allows devices to connect in the internet. By the help of internet virtual classroom have helped in educating students. In the covid-19 pandemic when all schools and colleges were closed virtual classroom help in providing education without any risk of spreading the virus. This is possible because an application of embedded system connects everyone and education is possible. The teachers and students are connected in a virtual meeting which provides quality information from teachers to their students.

Moreover, devices like a calculator can help in education. Many complex calculations can be carried out by the help of a calculator. This device is also an application of embedded system which is portable and easy to use. The calculator firstly converts decimal value into binary value and stored in the memory. Then an operator is clicked and it is also stored in the memory and the second number is also converted and stored in the memory. When equals to sign is pressed the stored information is processed by the athematic and logical unit (ALU) and the output is displayed accordingly. Inside the ALU the binary numbers and operator is passed through the logic gates and finally the output is sent to display.

3.4. Easy communication by the help of Embedded System,

Now a days communication is very easy. However, in the past communicating with people from one place to another was very difficult. Use of birds by tying a paper in their foot and sending people with the message or postmen with the letter were the main way of communication. However, embedded system has directly or indirectly affected the mode of communication. Devices like telephone, radio-FM and walkie-talkie are some examples of direct communication methods. Whereas, satellites can be the indirect application of communication.

For the indirect mode of communication by embedded system, the satellites which is based on embedded system is a perfect example because the satellites help in communication by using radio waves. The radio waves are transmitted by the help of ground stations which sends or reserves the information. If the information is being send from A point to B point, the information from A point reaches to the nearby ground station by the help of a router or similar devices. Then by using radio waves the information will sent to the satellite. From there, the information will be sent back to another ground station which is near B point. Finally, the information will be communicated from one place to another.

For the direct mode of communication by embedded system, the telephone which works when a unique number of the other side is dialled in their telephone. Those devices are connected by a telephone cable and those devices can communicate. This uses full duplex mode of communication which means this allows the user to communicate from both sides at the same time. If the cables are unharmed the communication is uninterrupted.

Moreover, radio FM is also an application of embedded system. This device works when the frequency of the user and host matches. This uses simplex mode of communication which means the communication is one-way communication only, where the host communicates with the users but users cannot communicate to the host. This type of communication is effective for delivering a message or news in a big mass. The connection of the users doesn’t matter for these ratio FM because the news or message will not wait for the host to connect.

Similarly, walkie-talkie is also an embedded system used for communication, this device works like a two-way radio. In a radio only the host can send messages whereas in walkie-talkie both ends of device can communicate but one-at-a-time if both users communicate at the same time the message will crash and the message will be hazy. This type of communication mode is called half duplex mode of communication. The use of this device can be seen in the military or the police. They use this device to communicate with their fellow subordinates or to make them aware about any important information.

3.5. Use of Embedded System for transportation,

In the past, people used to travel by walking which is exhausting and time consuming. Slowly, the concept of bicycles was introduced which was less time consuming but still exhausting. Then the concept of embedded system was used to make traveling less time consuming and exhausting. Some of those vehicles include airplanes, boats and cars. All those vehicles use more than one embedded system but the main purpose is for traveling.

Airplanes are one of the fastest modes of transportation and the route of transportation is by air. Many applications of embedded system like temperature control, speed control, sensors, flight management system and engine control (Industrial, 2019). Without those embedded systems the key operational features of the airplanes will be unavailable which will lead in the device to fail. Not just an airplane but aircrafts and helicopters also use similar embedded system.

Application of embedded system can be seen in maritime also, EMS-CDV-Marine is an embedded system which is ICE EN60945 certified (Mulcare, 2015). Marine embedded system allows applications like control room, integrated bridge systems and safety systems which has high reliable and low maintenance. The low maintenance and high reliable embedded system are very important in maritime because it is nearly impossible to fix it without an expert mechanic.

The embedded application stated before are used for traveling long distance. However, applications of embedded system like car, motorbike or bus can be used to travel short distances. These are comparatively more time consuming then airplanes and boats but can be used whenever the owner wants. Application of embedded system like heads-up display, Window Lifter, battery management, emergency brake system and many more are used in those vehicles.

3.6. Use of Embedded System in medical field,

Health is one of the things no one should compromise on. That being said applications of embedded systems like, CT scanner, MRI machine, and glucometer are used which can show what is happening in a sick person’s body.

Because of these doctors can provide medications according to the need of the sick person's body.

Talking about CT scan machine, it stands for computerized tomography scan. CT scanner emits a series of narrow beams through the human body as it moves through an arc (Brazier, 2018). It is used to produce a 2-D or 3-D image of a body part and can be used for further evaluation by the doctors.

Similarly, MRI machine, it stands for magnetic resonance imaging. A strong magnetic field and radio waves are used in this application of embedded system to create detailed images of organs. By this the organs will be visible without the need of doing surgery. Also, MRI is safer than CT scans because no harmful radiation is used.

Unlike other machines mentioned earlier, glucometer is small, portable, cheap, and easy to use. By this machine a person can be aware about sufficiency or deficiency of sugar in a person's blood. This application of embedded system is used by people suffering from diabetes to keep track of their blood sugar level. By doing so a person can make important decisions like doing exercise and maintaining diet.

3.7. Use of Embedded System in industry,

Industry is the place where goods are manufactured by raw materials in a huge quantity. To manufacture those goods big robots are used and those robots are applications of embedded system. Many robots which have a single purpose and are used to create finished good.

Robots are used to make goods, transport goods from one place to another, and packing then according to the brand of the product. For making goods, a robot is used which has a motor in it. The motor spins causing the raw materials to mix. Not just mixing but for cooking those materials a different robot is used.

For transporting from one robot to another, a machine-like escalator is used. This also uses a motor to operate. When a motor spins the attached belt also spins in a loop which leads to goods present in those belts to transport from one place

to another. This application of embedded system helps in moving goods from one place to another easily.

Lastly, the finished gods are packed and supplied to different places. While packing, all necessary details are printed in the wrapper which is used to pack the finished goods. This is also done by a robot which is responsible for cutting the right amount of wrapper and sealing the goods.

4. Conclusion

For conclusion, embedded system is a microprocessor-based hardware which is connected to input and output hardware which is used for a general purpose. Everyone uses an application of embedded system in their day-to-day life because it is easy to uses and makes life easy. The use of embedded system might be direct or indirect. Devices using embedded system are the direct use where industrialized goods are indirect use.

The use of applications of embedded system are so popular because it directly effects many aspects like social, physical, academical, psychological and technological. Therefore, by using applications of embedded system every work is easy and many impossible looking things can be done easily.

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