Ministry of Education and Science of Ukraine
Ternopil Ivan Puluj National Technical University

Faculty of Computer Information System and Software Engineering
(full name of faculty)
Department of Computer Science
(full name of department)

QUALIFYING PAPER

For the degree of

Bachelor
(degree name)

topic: Computer network development for a smart house

Submitted by: fourth year student 4 , group ICH-43
specialty 122 Computer science
(code and name of specialty)

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Ternopil
2022

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ASSIGNMENT

for QUALIFYING PAPER

for the degree of Bachelor
(degree name)

specialty 122 Computer science
(code and name of the specialty)

student Alrabid Alsulaiman Ahmad
(surname, name, patronymic)

1. Paper topic Computer network development for a smart house

Paper supervisor Nykytyuk V.V., PhD
(**surname, name, patronymic**, scientific degree, academic rank)

Approved by university order as of 19.11.2021 № 4/7-979.
2. Student's paper submission deadline 22.12.2021
3. Initial data for the paper task for work, structure of a smart home, ways to organize a network inside a smart home

4. Paper contents (list of issues to be developed)
The concept of the system "smart home", Features of the "Smart Home" system, Principles of organization of the Smart Home system, The main characteristics of the system, Elements of a classic residential installation, Ways to implement the system "Smart Home", Control the operation of the "Smart Home" system using a mobile phone, Implementation option from Smart Home, Overview of Automation and control Technologies, KNX/EIB And konnex organization history, Smart home network design based on KNX technology, labor protection
5. List of graphic material (with exact number of required drawings, slides)
Smart Home Networking, Reasons to have the smart home, The Smart Home is, Features of the smart home system, Remote access, Advanced security, Advantages and Disadvantages, aspects of house infrastructure management, Forms of the Smart Home, Smart home based on PC, Smart home based on the MegaD-328 controller, Ways to control the Smart Home with smartphone, Smart home network design based on KNX technology, Schematic representation of the KNX bus, Steps of the process of

programming an automation system, labor protection

6. Advisors of paper chapters

Chapter	Advisor's surname, initials and position	Signature, date	
		assignment was given by	Assignment was received by
LABOR PROTECTION	Okipnyy I.B.		

7. Date of receiving the assignment 06.09.2021

TIME SCHEDULE

LN	Paper stages	Paper stages deadlines	Notes
	Analysis of the task for qualifying work	06.09.2021	
	Writing chapter 1	24.09.2021	
	Writing chapter 2	15.10.2021	
	Writing chapter 3	26.11.2021	
	Writing chapter 4	21.12.2021	
	Preliminary defense of work	22.12.2021	
	Defense of work	05.01.2022	

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ANNOTATION

Information Technology: Computer network development for a smart house // Qualification work of the educational level "Bachelor" // Alrabid Alsulaiman Ahmed // Ternopil Ivan Puluj National Technical University, Faculty of Computer Information System and Software Engineering,

Department of Computer Science // Ternopil, 2021 // P – 59, Tables – 0, Fig. – 25, Diagrams – 0, Annexes. – 0, References – 20.

The paper discusses the architecture and implementation of a web-based tool for how to develop a computer network for smart house. First, this project covers the need for analysis of development a network for smart house. Then lay the foundations for the need for an effective analysis tool accessible to all.

Second, the architecture of the web application is studied in detail. The application is implemented with a pattern design which is a variant of the model view-controller. For efficiency and performance, Computer Network development for a smart house performed asynchronously using a task queue. The system also provides a REST service for GET and POST data.

Finally, the results of using the application are presented from the perspective of a web browser user.

Keywords: Network Development smart house (NDSH), PC Control, Sensors

LIST OF SYMBOLS, UNITS, ABBREVIATIONS AND TERMS

AQS - Actual Queue Size

ARIMA - AutoRegressive Intergrated Moving Average

AT- Actual Transmissions

CSV - Comma Separated Value

OCF - Open Connectivity Foundation

REST - Representational State Transfer

SDP - Session Description Protocol

IoT - Internet of Things

MAC - Medium Access Control

NN - Neural Networks

NoN - Number of Nodes

SNR - Signal-to-Noise ratio

TP - Transmission power

WSNs - Wireless Sensor Networks

CONTENTS

INTRODUCTION

Many modern-day human activities rely on the Internet, which connects many people and things all over the world. A smart house is one that has its own network system that connects all of its equipment and objects. A home network is what this type of network is referred to as A smart home is defined as an integration system that uses a variety of technologies to connect all interior subsystems that connect to home appliances and household electrical equipment as a whole, including computers, network connectivity, and synthesized wiring. Smart home technologies allow households to successfully centralize administration and services in their homes, provide all-round functions for internal information interchange, and assist in maintaining instant touch with the outside world in this way. In terms of practicality, they assist people in optimizing their lifestyles, adjusting daily schedules, and so on.

These work describes what a "smart house" is, which is a home with a "intelligent" system that can handle several appliances and services, and is intended for anyone who is planning a new construction or renovating an old one, or who is simply curious about what it means to have a "smart house."

Reading it will teach you about the unique features of a smart home system, the basic and advanced services a smart home can provide, the fundamental differences between a standard electric system and a smart home system, and a slew of other insider details about which you will never be informed as a simple customer.

Reading it will teach reader about the unique features of a smart home system, the basic and advanced services that a smart home can provide, the fundamental differences between a standard electric system and a smart home system, and a wealth of other insider information that you will never learn as a simple customer

The electronics in a smart home are all networked and may be controlled from one central location—a smartphone, tablet, laptop, or gaming console.

Self-learning capabilities are built into smart home appliances. Lighting control in smart homes allows homeowners to save money on energy by reducing the amount of electricity they consume. When motion is detected in the home while the homeowner is away, some home automation systems send an alarm to the homeowner.

CHAPTER 1
THE CONCEPT OF THE SYSTEM "SMART HOME"

1.1 The concept of the system "Smart Home" and the principles of its implementation

The "Institute of Intelligent Buildings" in the United States came up with the concept of a "smart" dwelling in the early 1970s. A smart home defined "a residence that delivers productive and efficient workspace..." at the time.

The modern "smart" house, on the other hand, may be traced back to The businesses X10 USA and Leviton developed and introduced in 1979production technology for managing domestic appliances on wires of a household power supply network this year in the United States.

Because they were designed to function at a voltage of 110 V and a network frequency of 60 Hz, these inventions were exclusively popular in North America at the time.

X10 technology was groundbreaking in the late 1970s. It was, however, only intended to serve six management teams and was primarily used to handle electric lights.

In order to hasten the evolution of all such technologies,The Electronic Industries Alliance was founded by their creators. The Customer Electronic Highway (CEBus) standard was established in 1992 as a result of this. CEBus is now an open standard. This means that "smart" home equipment can be manufactured by any company whose goods match the appropriate technological specifications. Today, the CEBus communication protocol allows a signal to be transmitted via household lines, twisted pair, coaxial cable, radio waves, or thermal.The notion of a "intelligence building management system" gives a whole new approach to the organization of a building's life, in which a combination of software and hardware dramatically improves the efficiency and reliability of managing all of the building's systems and actuators.

A "smart home" should be viewed as a system that can reacognize and respond to certain conditions that occur in the building: one of the systems can regulate the

behavior of others using pre-programmed algorithms. Individual subsystems are integrated into a single managed complex, which is the core aspect of the intelligent building. A key characteristic and property of the "Smart Home" that sets it apart from other ways of organizing living space is that it is the most advanced idea of human interaction with living space, in which one person in one team creates the desired environment and automates it according to that environment.

Sets and monitors the modes of operation of all engineering systems and electrical appliances in response to external and internal factors. When viewing TV, many remote controls are required, as are dozens of switches for lighting control, individual units for ventilation and heating system control, video surveillance and alarm systems, gates, and other items. One keystroke is all that is required to select one of the scenarios in a home equipped with the "Smart Home" technology (or remote control, touch panel, etc.). To provide a comfortable environment within the house, the house will change the operation of all systems based on the wishes, time of day, location in the house, weather, outdoor lighting, and other factors.

The following provisions are included in the intelligent building concept:

- Development of an integrated building management system - a system capable of ensuring the seamless operation of all engineering systems in a building.lighting, like heating, ventilation, water supply, access control, and many other aspects of the structure

- All building maintenance staff will be eliminated, and the control and decision-making duties of subsystems will be transferred to the integrated building management system. These subsystems include the building's "brain" - how it will react to changes in the system sensors' parameters as well as other events such as crises.

- Implementation of a method for immediate disconnection and transfer, if necessary, to the intelligent building's administration of any subsystem. At the same time, a person should have easy and equal access to all subsystems and elements of the "Intellectual House's" management and display.

- Securing efficient functioning of sub - systems in the event of a system breakdown

1.2 Features of the "Smart Home" system

Figure 1.1 – Scheme of a smart home

Figure 1.2 – Scheme of a smart home

1.2.1. Home network with advanced features.

By now, we most likely heard of the "Iot technology." It defined as a network of wireless managed gadgets that is becoming an increasingly important element of our lives and is at the heart of the smart home. The automated house need something more durable than a wireless router buried. It will require enterprise-class networking

equipment as well as a number of wireless access points strategically distributed throughout the house.

An efficient home network serves as the brains of your smart home, connecting all of the different parts of your automated system and ensuring that they work together. This is the most important part of a smart home that works well,without the need to clone oneself.

1.2.2. High-level security.

Traditional security systems inform authorities in the fire situation, tear, or other tragedy, but the automated home's sophisticated protection goes much further. For instance, many SH systems are capable of sending intelligent signals that distinguish between welcoming visitors and strangers. The best part is that, as part of your home automation installation, an advanced home security system is totally customized to your specific security needs.

1.2.3. Power supply.

Various electrical equipment is employed in modern dwellings, particularly cottages. These include ventilation systems, swimming pool water purification, various lighting devices, and roof and road anti-ice systems.

All of this equipment requires a lot of electricity, and most networks aren't designed to handle it. The system allows for the creation of a priority system.

It will turn off the device with a lower priority after testing all of the network's equipment and determining that the reserve has been depleted. The electrical contact between the electronics and power conductor is the repeater network power supply. The repeater is powered by the underwater cable's power conductor, which has voltages up to 15 kV and a total current of 500 to 1500 mA.

1.2.4. Lighting.

Advanced Lightbulbs have software that connects to an app, smart home assistant, or other digital accessory, allowing you to automate or control your lights remotely.

The control capabilities of the lighting subsystem are as follows:

1. Turning on/off the light while removing/putting the system on full protection;

2. Using the timer to turn on/off various light sources;

3. Motion sensors regulate lighting, with the delay time to turn off the light specified. This type of lighting control is commonly found in "passage" rooms (vestibule, corridor, etc.). The light goes on when a human motion sensor is detected in the vicinity. The light goes off when a specific amount of time has passed since the sensor has stopped "seeing" the person;

6. Using light sensors to control various light sources; 7. Using the system panel to turn on and off various light sources;

8. Using a computer to turn on and off various light sources;

1.2.5. Gas supply

Toxic gas management is made to turn off the gas supply and notify in the event of an emergency, reducing the damage caused by a potential explosion and room ignition (house).

The sensors in potential gas leakage locations will send a signal to the system, which will activate the alarm, ventilate the area, and turn off the electricity, leaving only the emergency lighting on. In the event of a collision, the system will notify the driver.

1.2.6 Heating (radiators, air, "warm floors")

The technology allows you to adjust the temperature of multiple rooms (to 512). Temperature range for measurement and regulation of fixed temperatures is 0 to 125 degrees Celsius (sauna).

Also every room does have its own weekly routine, with different heating control modes for weekdays and weekends. Divide the day into two time zones, which are commonly referred to as "night" / "day" and "day" / "night."

Depending on the value of the current temperature, the system processes signals from linked sensors and includes (switches off) the connected heat sources (electric heat-insulated flooring, IR panels, electric convectors), bringing the temperature of the room to the predetermined temperature.

In a house, underfloor heating is comparable to that found in an apartment, but it is most commonly utilized to heat rooms in general. It is critical to understand that without a smart home, achieving optimal and coordinated functioning of the heated floor and radiators is quite impossible. It'll constantly be too hot or too cold. When you throw in air conditioning and ventilation, it becomes much more challenging to achieve

the ideal temperature. You'll be continually switching the air conditioning, heater, and extractor hood on and off. Is that why you're building a house, because it's so boring and inconvenient

1.3 Principles of organization of the Smart Home system

1. The SH makes life easier for the user.

Smart home is not a game for scientists; it is a system for life. Smart homes do not have systems that are more complicated to use1 than a switch.

This principle must be applied to any new thing. It is not for Smart home if you do not understand how to enhance it to make life easier.

The user's interaction with the system is the second most important principle:

2. Functionality is less important than a positive user experience.

It's pointless to spend money on a cool technology that's difficult to use. In compared to elaborate devices for all possible purposes and applications, simple and reliable gadgets with limited functionalities have a considerably higher probability of success.

3.Customization is preferable to convenient interfaces.

If user don't know how to mix several tasks with a simple interface and merely stock all functions in the hopes that a user would figure it out on their own, users might want to reevaluate their professional path.

Remove some options if users don't know how to combine convenience and a variety of functions. Any function is preferable than a standard switch. However, if it is very difficult, the user will return to a switch.

The same can be stated for the work's quality. A button that simply turns off the light is preferable than a dimmer that works sometimes and doesn't work at all.

1.4 The main characteristics of the system

A system is an organized collection of interdependent components that are connected together and in accordance with a plan to achieve a certain goal. There are three main implications of studying system concepts:

A system must be developed to accomplish a certain goal.

Interdependence and interrelationships between the components are required.

The overall aims of the organization take precedence over the objectives of its subsystems.

System characteristics include:

Association:

It suggests order and organization. The arrangement of components aids in the achievement of goals.

Interaction:

It describes how each component interacts with the other components of the system.

Interdependence:

It signifies that different sections of the organization or computer system are interdependent. According to a strategy, they are coordinated and linked together. For proper operation, one subsystem relies on the output of another subsystem.The term "integration" refers to the holistic nature of systems. It is concerned with the way a system is connected.

A system should have a primary goal. Real or declared goals are both acceptable. Although a declared goal may be the true goal, it is fairly uncommon for an organization to declare one goal and work toward another. The crucial element is that for a successful design and conversion, users must understand the core goal of a computer application early in the analysis.

The many components of a Smart House are being explored, however there are still certain gaps in terms of a system that can be implemented utilizing modern technology. We offer an overview of the Smart House subsystems required for efficiently and safely controlling the house via a mobile application in this article. The

sequence diagram for connecting the mobile application to the server application, as well as the possible usecases, are shown. The difficulties encountered in building the mobile application and showing the updated house top plane view in it are described, and solutions are proposed.

Finally, the intended mobile application was created, and key features such as the interactive house top view map, which displays the status of devices using predefined icons, were described.

Functions You can do with smart home system

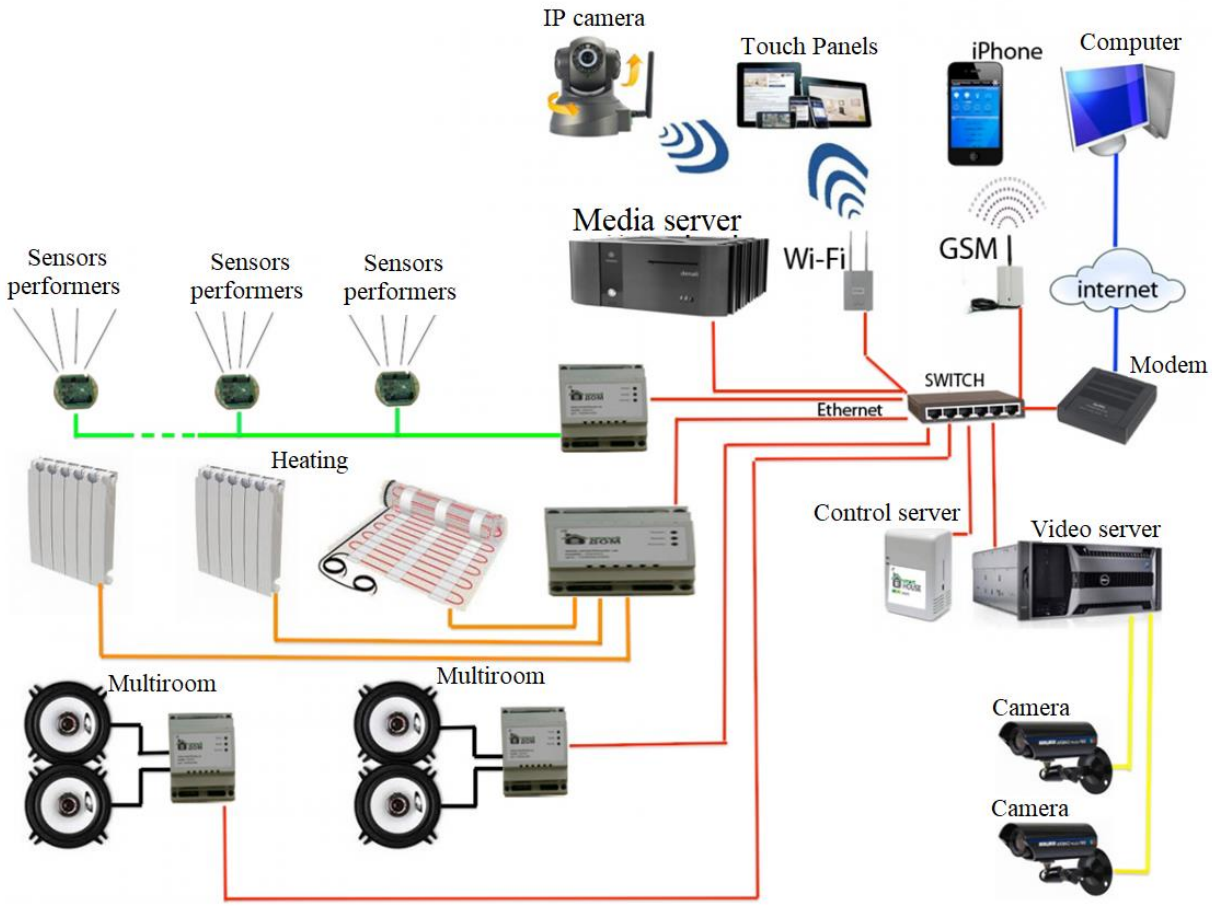

Figure 1.3 – Scheme of a smart home

1.5 Life Safety

Smart switches, cameras, locks and other gadgets may improve smart home security while also improving your lifestyle.

The best thing is that home automation and security are now linked into a single ecosystem, opening up a world of new possibilities.

Technology's future has already arrived. All we have to do now is find out how to incorporate it into our daily routine.

Put an end to the Thermostat Wars.

Nest, with its "learning thermostat," arguably fired the first salvo in the home automation revolution in 2011,Other thermostats have previously only been programmable to a limited extent. Nest developed a home automation system that learnt your habits, such as whether you want it chilly or hot, or when you'll be home or away.

It's a tried-and-true method of conserving energy and money while also making you more comfortable.

Nest and other technology businesses have since expanded their reach into home automation and security.

Door-to-Door Protection

Simply walk outside your front door to encounter a spot where home automation and security collide. The simplest approach to keep your house secure is to never allow intruders in.

Millions of people use simple-to-install video doorbells to see, hear, and chat with visitors. You don't even need to be at home; everything is handled via smartphone. Nothing can terrify a potential thief more than being told to leave.

Locks Have Been Reimagined

Another home automation and security marriage might be found not far away. Door locks have progressed well beyond the traditional key, and they now do much more than keep intruders out.

Some of the most tangible advantages of home automation include door locks:

When someone arrives or departs, an automatic smartphone alert is sent.

Thanks to your smartphone, you can lock or open your door automatically. This is especially useful when your hands are busy or you're driving away and forget to lock the door.

Remember to Include the Garage Door.

Anyone who has ever driven a few miles away from home and then realized they forgot to close the garage door understands the usefulness of smartphone control. There will be no more turning around to check.

Video that is both powerful and affordable.

It's much easy to integrate home automation technology into your daily routine once you're inside the house. You won't have to worry about what's going on while you're away. With live or recorded video, you can see for yourself.

Previously, sophisticated video cameras were only available to organizations with valuable goods to secure or merchants looking to reduce stealing. However, as a smart home security technology, video monitoring has become shockingly inexpensive and simple for homeowners.

Allow your light to shine.

It's common knowledge that thieves avoid well-lit houses at night since they're more likely to be inhabited. When there's no one around, it's considerably safer.

It's not a good idea to leave the lights on all the time. However, the solution is once again in your hands. With your smartphone, you can adjust lights from anywhere.

That is, of course, only one component of the home security/automation issue. It's about safety as well as convenience. You may wander throughout the home shutting off lights that have been left on inadvertently, or you can check and switch them off using your smartphone.

Voice Control Will Be the Technology of the Future.

Voice-controlled "virtual assistants" are used by millions of individuals, thus they appear to have been around for a long time. Apple, on the other hand, debuted Siri in 2011, while Amazon's Alexa debuted in 2015 and Google Home debuted in 2016.

Voice-activated devices may be as basic or as complex as you wish. Some individuals use them to look up the weather, listen to music, or find answers to problems.

1.6 Conclusion of the chapter 1

Smart homes are more than a technological advancement. A contemporary person's first requirement is a smart house. Indeed, we spend a considerable portion of our lives on the premises, and they should help us preserve our health as much as feasible. This should include, in particular, the maintenance of psychological health: in today's digital era, everyone feels the strain of information flow, which may cause pain, stress, and even sickness. The objective of smart home information systems is to process such a stream and choose just the most important and interesting items for a person.

The smart house, on the other hand, protects physical health. This is aided by numerous climate control devices, which generate an optimum "environment" in the rooms invisibly yet unconditionally. Those seconds of human life that they save day after day become extra years of our lives.

CHAPTER 2
DIFFERENCE BETWEEN A SMART HOME SYSTEM AND A STANDARD ELECTRIC PLANT

2.1 Elements of a classic residential installation

Connections and wires

Since January 2003, voltage used in Europe has been standardized at 230V 50 Hz. Line (letter L, color brown or black) and Neutral (letter N, color brown or black) conductors are used to distribute it (letter N, color blue). There is an alternating voltage (AC) with a sinusoidal shape between them.

Current is said to flow from the line conductor (cable) via the load (such as a lamp or an appliance) and then back to the power supply source via the neutral conductor. This isn't quite accurate because our homes' power lines are AC, thus the current direction changes every half-hour. In any case, we can refer to the line cable as the "supply" and the neutral as the "return" for simplicity.The purpose of the final device, i.e. its power, determines the optimal conductor choice.

When choosing the correct cable, the strength of the current it can withstand permanently is the most significant consideration. Lighting, for example, often uses a 1.5 mm2 conductor with a 10 A protection, whereas sockets typically use a 2.5 mm2 conductor with a 16 A or larger protection, depending on the customer.

The voltage drop from the distribution cabinet to the home connection measuring cabinet is also calculated while estimating the conductor. The conductor's maximum allowable voltage drop is 4%.

In our electric plant, all of the loads are connected as shown in the diagram below.

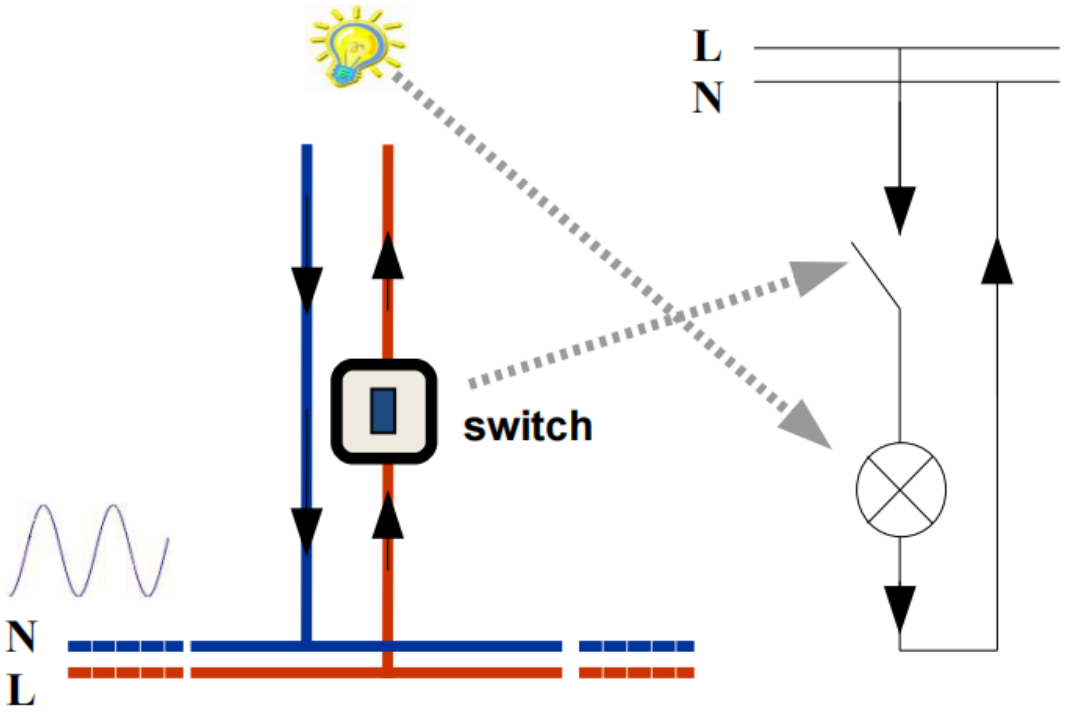

Figure 2.1 – Load and switch connection in a standard electrical system

A third wire, named "Protective Earth" (letters PE, color green/yellow), is also present.

For safety purposes, this cable connects all electrical outlets to the earth potential. Appliances with metal chassis are linked to ground wire so that if the appliance's insulation fails, current will be shorted to earth, tripping the breaker or melting the fuse on that circuit, thus safeguarding human life.

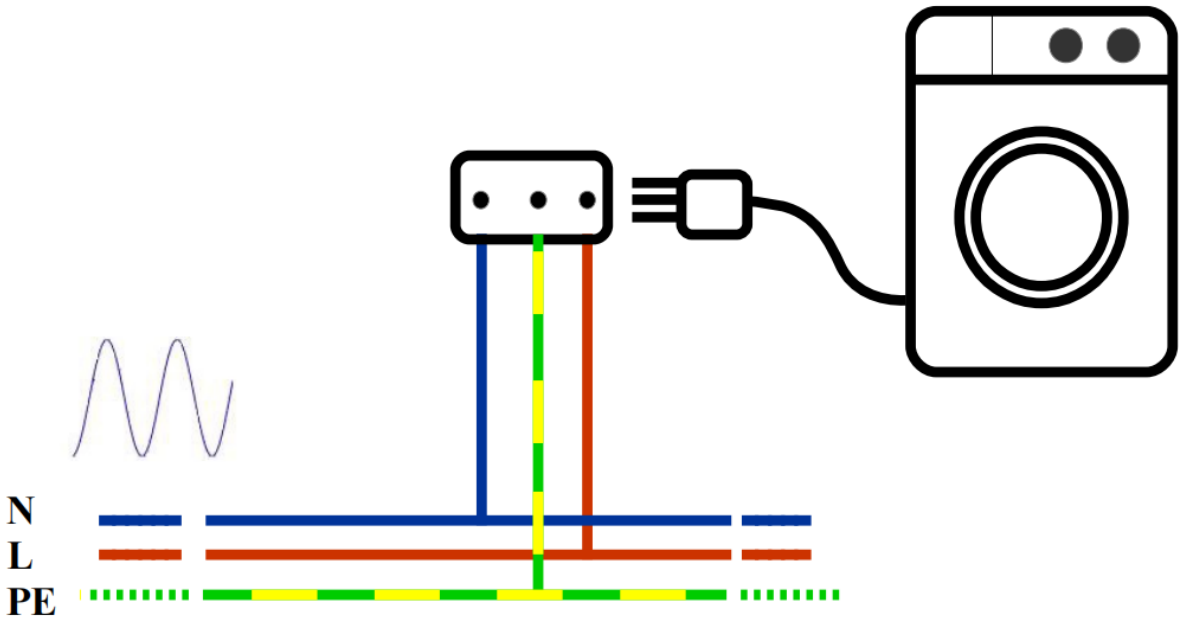

Figure 2.2 – Protective earth cable

The switch is the point in a conventional electrical system where the user decides whether to turn on or off the load (hence the command) and also where the line is connected or not to the load (thus is the actuator).

Protective devices Protective devices are installed in buildings in order to protect the performed electrical installation from failure due to excessive heating and short-circuit current, and to protect people from electric shock. Some examples of protection devices are: 1. Circuit breaker: serves to protect the conductors from overcurrent from the place of their installation to the load, but not the load itself.

Figure 2.3 – Circuit breaker

Generator circuit breaker: also known as a "differential switch," it monitors the input and output currents and interrupts the circuit if a difference is created (the missing current could flow into a human's body).

3. Combined circuit breaker: is a device that combines the functions of an automatic circuit breaker and a residual current device and is therefore a practical element if we have a problem with lack of space in the distributor.

Figure 2.4 – Combined circuit breaker

2.2 Ways to implement the system "Smart Home"

2.2.1. General provisions

1. Decide on your very first smart devices.

There are indeed a plethora of ways to control your house, making it easy to overspend on smart devices you don't require. We recommend beginning with one or two smart devices and gradually adding more.

Smart devices can be purchased on practically any budget. Decide where your boundaries are.

Setup: Stick to smart gadgets that are easy to use and fit your ability level—some electrical equipment require more technical knowledge to set up than others.

Because everyone's lifestyle is different, the smart device that your neighbor swears by might not be right for you. Basic lifestyle categories can be found in our section on a balanced smart home.

Research: Read consumer reviews, buyers advice, and independent reviews before making a purchase. You don't have to do as much research as we do (that's our job), but other points of view are always beneficial.

Below, we've highlighted some of our favorite smart home gadgets for beginners that are simple to use, inexpensive, or simply too amazing to pass up.

We also provide links to pertinent comparisons of the top smart home goods and possible device combinations to assist you in selecting your new smart device.

Smart speaker.

The best way to begin automating your house is with a smart speaker. The Amazon Echo Dot is a low-cost smart speaker that runs on Amazon's Alexa smart home platform and costs around $50. It also works with a large number of devices.

Figure 2.5 – Smart speaker

What should you get to go with your smart speaker?

No more leaving the warm blankets to turn off a light switch with a smart light bulb.

To see if the front door is secure, use a smart lock.

A smart thermostat to help you get ready for work in your home office

Smart light bulb.

Such devices are one of the most cost-effective and straightforward methods to begin automating your house. While we appreciate multicolor light bulbs because of their versatility. Using a mobile app or your voice, you can easily schedule and dim your lights. Although it does not allow different colors, it is a cost-effective solution from one of the greatest smart home brands.

Figure 2.6 – Smart light bulb

What should you get to go with your smart light bulb?

When you get home, a garage door opener will turn on your lights.

Before going to bed, use a smart speaker to dim the lights.

A video doorbell that uses the light bulb to signal when a visitor is approaching the front stairs.

Smart plug.

Smart plugs are inexpensive, simple to install. You may use an app to set timers and schedule lighting once everything is set up. The Wemo Mini (about $25) is small enough to not block the other outlet. Wemo also offers an away mode that makes it appear as though you're at home, even if you're not.

Figure 2.7 – Smart plug

What else should you get to go with your smart plug?

To control your favorite lamp, use smart speakers.

To operate a fan, use a smart thermostat.

Smart light switches can control several light fixtures and bulbs at the same time.

2.2.2. Smart home based on PC.

1. Domoticz

When it comes to matching their gadgets with software, compatibility is one of the most important factors to consider. When you install software that isn't fully compatible with all of your desktops and devices, it can be really frustrating.

Domoticz features support a wide range of device families, so users are usually comfortable using it. It's fantastic that they can rely on a platform that works with all of their devices, and it's one of the most critical features to look for in automation software. If you can't get it to interact with the brand new smart devices you got, all of the other functions are useless.

One of the most appealing features of Domoticz is that it can be used on a wide range of platforms, from traditional computers to cellphones and even the ultra-low-cost power solution Raspberry Pi. You get access to a bunch of other optional implementations from third-party developers in addition to the standard software.

The software developer's website includes a list of all third-party benefits, making it simple to discover what's available and how you might profit directly. When all of the functions are combined, it becomes clear that Demoticz was designed not just for ordinary home automation, but also for much more. Allowing external devices to be used is a tremendous benefit in and of itself, let alone when it is integrated into the overall system. When it comes to experimenting with the system, Demoticz users can construct special switch codes, that can be extremely useful in a variety of scenarios.

2. Calaos

We can't talk about home automation without mentioning Calaos. Calaos, or The Calaos Project as it is also known in some quarters, has left an indelible effect on home automation. This automation system is a joy to use if you're looking for a source of community support.

Calaos could be exactly what you're looking for if you're searching for a full-stack platform that can handle all of your automation needs.

A server application is one of the features included in this software, and it will come in handy. It also features a touchscreen UI and a web app for complete control over the environment,Because mobility is such an important part of the link between automated homes and their owners, you'll need a mobile app. Calaos comes with native mobile software that works on both Android and iOS devices, therefore the operating system infrastructure is far more extensive and developed than that. The Linux operating system is preconfigured and can be extremely useful when tinkering with settings and,The only negative point to mention is that much of the documentation for Calaos is in French. However, it is not entirely French, and you will be able to discover some English material. However, a large portion of the support material, including the help forums and a portion of the software's instructions, is in French. If you're interested in Calaos, you should know that the source code is available on GitHub. In terms of licensing, it's covered by the GPL v.3 license.

3. OpenHAB

This software is known by the acronym OpenHAB (Open Home Automation Bus). You can probably figure out why they prefer the former. OpenHAB, on the other hand, caters to the requirements and desires of open source-obsessed home automation explorers.

This program is backed up by a thriving community as well as the creator. In the speciality circles, OpenHAB has a sizable following and is a well-known home automation system. If you're searching for a robust and supported platform for all of your devices, OpenHAB is a good choice, as this Java-based software has a number of connectors that make your job a lot easier.

Despite its extensive compatibility list, OpenHAB makes no attempt to appeal to any specific device, as it is designed to avoid "taking sides," as it were. That means developers have a lot more leeway when it comes to integrating their own technology and plugins into the mix,The accompanying iOS and Android apps can also be used to control devices via OpenHAB. OpenHAB also includes design tools that allow you to experiment and create your own interface and user experience.

The source code for OpenHAB is available on GitHub, as one would expect from an open source solution. It's included under EPL in particular (Eclipse Public License).

2.2.3 Smart home based on the MegaD-328 controller

MegaD-328p for Smart Home Automation controller

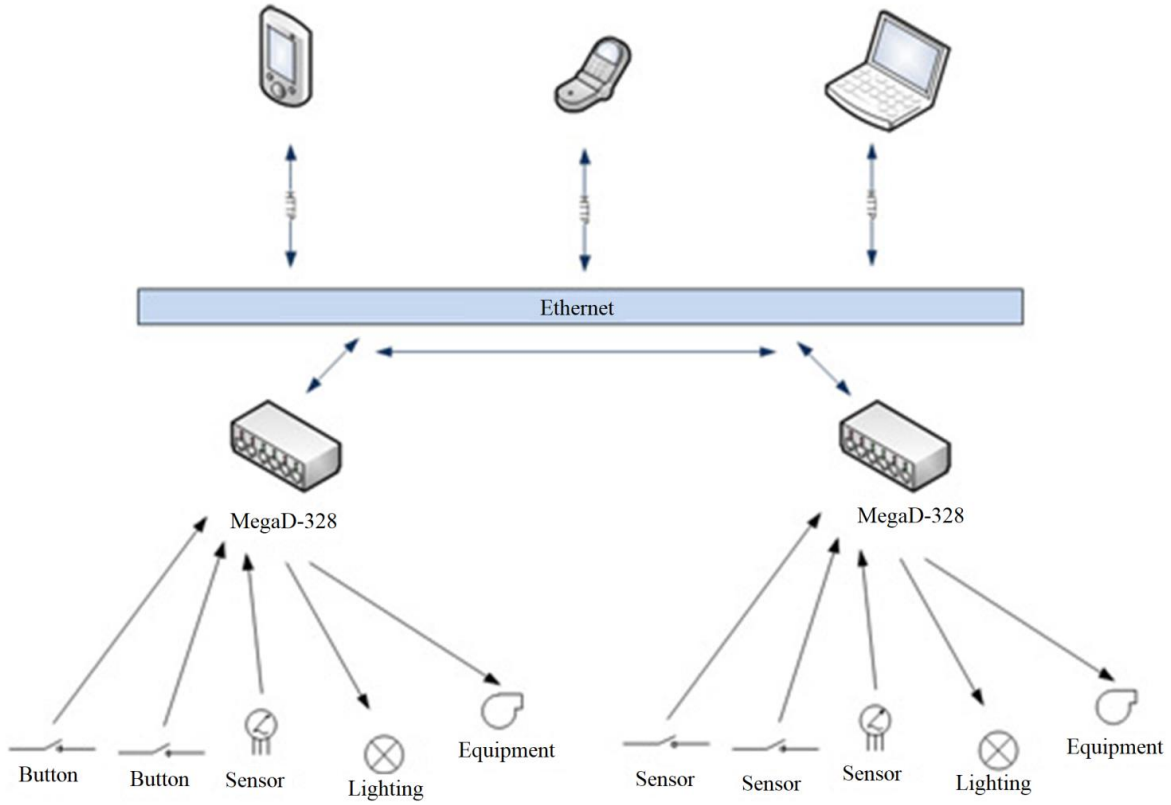

Figure 2.8 – Scheme of using MegaD-328 without a server. Automatic and Web-based management

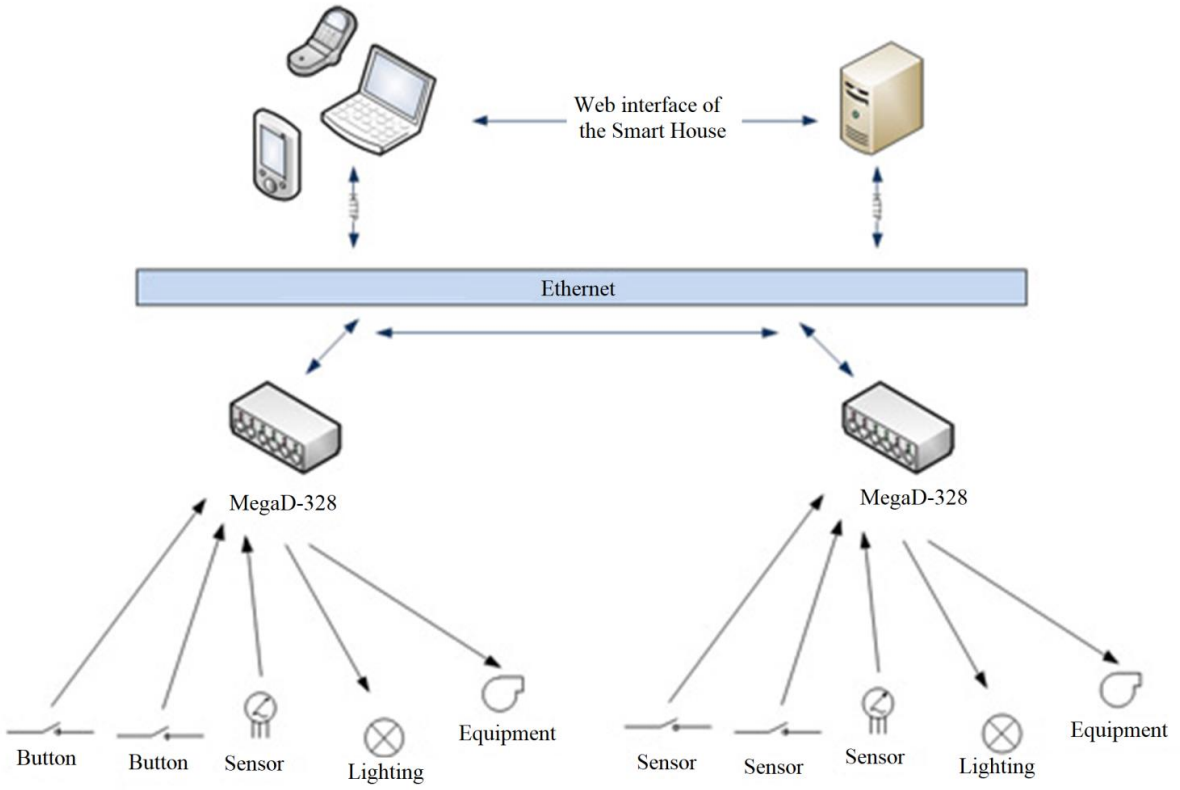

Figure 2.9 – Diagram of using MegaD-328 with a server. Management of loads both directly and on command from the server.

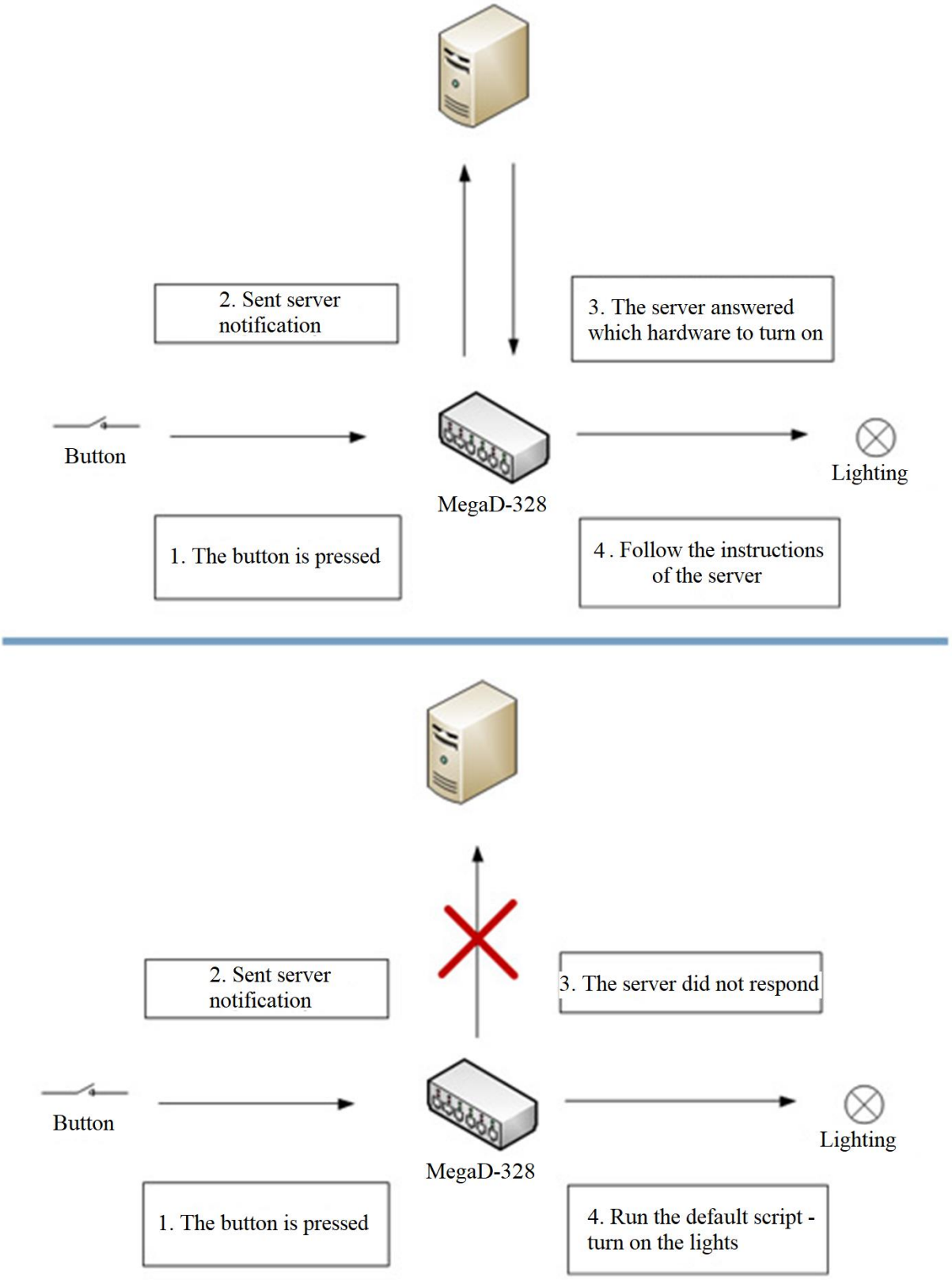

Figure 2.10 – Scheme of work in case of the functioning server and in case of its failure

Figure 2.11 – Controller board (interface module) MegaD-328 (Rev 5)

Through this project we have tried to show automatic control of a house as a result of which power is saved to some extent. Home automation entails giving certain electrical and electronic systems in a structure some level of computerized or automatic control. Lighting, temperature control, and so on are examples of these.

WORK PROPOSED.

In this paper, we present a framework for controlling IoT devices.

As a result, modern homes are becoming more automated as a result of home equipment.

The world wide web In this Internet-of-Things-based smart house project,

The ATmega328 microcontroller is utilized to accomplish all of the tasks.

Operations. The house is controlled by three loads in this method.

There are lights and a fan in the room. Our user-friendly UI makes it simple for anyone to use.

These home equipment can be readily controlled via the internet.

The entire unit can be run off the mains,Using a 230V main to 12V secondary step-down transformer The output voltage is generated by a full wave rectifier followed by a capacitor filter. As a 12v relay in this system

Due to the use of the module, a 12v power source is required; this power supply is taken from a step-down transformer's secondary 5V

The microcontroller requires a power supply.

The ATmega328 microcontroller, the LCD, and a portion of the relay module circuit. So, a 12v supply is connected to a 7805 voltage regulator. This voltage regulator outputs 5 volts. A 3.3v power supply is required.

As the ESP8266 wi-fi module runs on batteries, this is utilized to power it.

This supply will be made utilizing the LM1117 voltage regulator that can be set to 3.3 volts with the help of some software

With this, you may make a voltage divider circuit.

The microcontroller will communicate with the computer through USB,The ESP8266 Wi-Fi module sends and receives data from the server and responds by turning on or off relays or loads, as well as showing the status of loads on an LCD. The status of connected AC appliances is displayed on a 16x2 LCD display. As a result, this solution enables effective smart home control over the internet. The IoT-based Home Automation block schematic

2.3 Control the operation of the "Smart Home" system using a mobile phone

1. Ways to Control Your Home with Your Smartphone

Isn't it true that the smartphones is only as good as the apps you have? Of course, I'm well aware that a good smartphone includes more than just apps. Cameras, Internet access, file storage, or whatever else you want to do with it, but with the appropriate software, you can accomplish a lot more than you think. Indeed, with the correct tools, your smartphone may be able to pay for itself.

Let's look at some of the ways we may control our houses with our gadgets. Today home devices are very "smart." That implies they have more powerful computer

chips implanted in their plastic/stainless steel bodies, and they can communicate with one another and your smartphone over Wi-Fi. Here are ten methods to control your home using your smartphone.

Thermostats with built-in sensors

Nest, a clever little device, has been garnering a lot of attention lately. Do you recall the iPod? Well, the same people that designed the iPod also came up with an extremely cool thermostat. This thermostat is Wi-Fi enabled and has an iPhone app. That means you can regulate your home's temperature from anywhere!

Motion activated security cameras

Figure 2.12 – Motion activated security cameras

A motion monitoring system for your house is almost as good as cable television. There are a variety of useful apps available, as well as small but high-quality security cameras, that allow you to keep track of who is in your home. These cameras do not record everything; instead, they turn on when motion is detected. It can send you an alert on your phone when it turns on, and you can see live footage from your house from anywhere in the world. What a vacationer's paradise! You can also change the security settings using your smartphone.

Security system

Remember how you installed a home security system a few years back, with the control panel conveniently situated near the garage door or master bedroom? You may do it through your smartphone, thanks to the availability of mobile computing. You'll also be able to get fast notifications if there's been any wrongdoing. ADT, SimpliSafe, Vivint, and Frontpoint are some of the home security providers that allow you to control your system from your phone.

Smart keys

The use of traditional lock and key deadbolts to unlock doors is a thing of the past. When you upgrade your lock and key system, you gain a lot of protection, such as not having to worry about someone manufacturing a carbon duplicate of your key and using it to enter your home when you're not there. It also implies that you can check at any moment which doors are unlocked or open. You may also create temporary keys for folks who only require access for a limited time. But, most crucially, this means you no longer have to carry clumsy keys in your pocket to get into your house. As I previously stated, Lockitron is at the forefront of this innovative technology.

2.4 Implementation option from Smart Home

Smart home security is becoming increasingly vital. Although Internet of Things (IoT) devices are gaining more access to private data, this does not always imply that enhanced security and availability procedures have been deployed. The fundamental issue is that the nodes in the network have limited computational power and memory. Furthermore, IoT systems are increasingly being administered via the cloud, resulting in their interfaces being accessible via the Internet. Another issue is user inexperience, which can result in configuration problems, resulting in data loss and hacker assaults. We address security and availability challenges in smart homes in this article, and we suggest an edge-of-things approach that focuses on putting house administration at the edge. In a similar way, the network operator is in charge of management,as is the case with today's set-top boxes for home multimedia streaming. We propose a system architecture for this system, develop the required modules, and test it for security and

availability. The findings suggest that the proposed edge-of-things technology is capable of addressing many of the issues that currently exist in smart home applications.

Hackers can use a variety of techniques to get unwanted access to sensitive data stored in smart home devices [1]. Some of these techniques are passive, meaning they read data without altering it. Such assaults are particularly harmful because they may be carried out in such a way that the user is unaware that his system's security has been compromised and that unauthorized individuals have access to the data stored on it. Eavesdropping and traffic monitoring are two examples of passive assaults [2].

The system's specification and implementation

Gateway for smart homes

The implementation details of the created home gateway are presented in this section. The smart home gateway, like set-top boxes, is a device offered by network carriers. Because gateways will be operated by network operators, suitable security levels may be ensured by providing frequent software upgrades and secure communication channels.

2.5 Conclusion of the chapter 2

Different types and ways of organizing a data exchange network in the structure of a smart home are analyzed. The advantages and disadvantages of such technologies are highlighted.

CHAPTER 3
SMART HOME SYSTEM TECHNOLOGIES

3.1 Overview of Automation and control Technologies

On the market, there are a variety of smart home systems to choose from.

Every system is built on a unique technology that allows data to flow between all of the smart home system's components.

The performance, scope, and data rate of these various technologies vary.

These are some of the technologies:

- Interbus: is a data bus for sensors and actuators. It has a ring topology that is based on the.

The RS485 interface has several advantages, including the ability to transport data within the network system with a length of up to 13 kilometers and easier fault detection in urgent situations The downside of this method is that if one device fails, all of the others do as well.

Due to the ring topology and the location inside the bus, devices do not require addresses.

For identifying purposes, the ring suffices. This bus has a data transfer rate of up to 500kbit/s.

- P-NET is a form of master-slave bus. It has an RS485 interface, however it may also be used with a TP or RS232 interface at a lower data rate. A bus of this type may be up to 1200 meters long.

The data transport rate is 76.8 kilobits per second

- Profibus: data is sent via an RS485 interface or an optical connection. There are a few

Profibus-FMS, Profibus-DP, and Profibus-FMS are three versions of this technology.

(Process Automation) and Profibus-DP (Decentralized Peripherals), which cover a wide variety of applications potential uses, and they can work together, CAN (Controller Area Network): Due to its high data transmission rate of 1 Mbit/s and low

data transfer length of 40 m, CAN is ideal for automotive applications. When transmitting data, it employs the CSMA/CA technique.

The American corporation Echelon created LonWorks, an open networking technology for creating automation and control networks. It is built in such a way that it may be utilized in both centralized and decentralized building automation controllers. LONWORKS is standardized bus system (ANSI/CEA-709.1-B and EN ISO/IEC 14908) that allows intelligent devices to connect with one another over a locally controlled network. Local Operating Network (LON) is an acronym for Local Operating Network. For further technical details on the Lonworks technology, see the Appendix, BACnet (Building Automation and Control Network) is a standardized data communication protocol designed for use in building automation. In 2003, the international ISO 16484-5 standard was granted to BACnet, which is utilized in a wide range of building automation systems throughout the world. The necessity for a standardized data communication protocol that would enable diverse automation and control systems led to the development of BACnet,Interoperability and manufacturer independence are ensured by allowing building components to communicate with one another. For further technical details on the BACnet protocol, see the Appendix.

ZWAVE: Z-Wave is a next generation wireless technology created by Zensys in Denmark that allows all electrical parts to connect wirelessly with one another and with the user. Following the initial installations, the Z-Wave Alliance was formed in 2005 as a group of firms that provide connected appliances that can be operated via applications on smartphones, tablets, and PCs. It transmits a radio signal with a frequency of 868.4 MHz and a maximum strength of 20–30 mW.

It accomplishes this by employing simple, dependable, low-power radio waves that can readily travel through barriers.

3.2 Why KONNEX

In addition to the others, the Konnex standard exists.

Konnex, abbreviated as KNX, is the name of a technology, or standard, rather than a firm. With a European regulation (EN50090), a Chinese regulation (GB/T

20965), an American regulation (ANSI/ASHRAE 135), and a global regulation (ISO/IEC 14543-3), this technology has been standardised and recognized all over the globe. There is no single producer of KNX elements in the world. Instead, the Konnex group now has over 419 registered manufacturers. These companies together generate almost 7,000 distinct KNX components. This manufacturer's number,assures a constant supply of KNX components for the duration of your home's life. 419 manufacturers aren't going to go out of business overnight.

Most other smart home systems rely only on their own manufacturing of components, causing them to break more quickly and interrupting the flow of spare parts to your system.

Apart from the KNX OEMs, there are more than 70631 registered KNX partners (or "experts" or "designers") across the globe who develop and setup KNX systems. And the number is steadily increasing.

This means you can enjoy your smart home for the rest of its life without having to worry about spare parts or servicing.

Other rivals will find it difficult to give such a long period of assistance,And those are the reasons why, after giving you a broad overview of smart home systems, we've opted to focus on the Konnex standard in this article.

3.3 KNX/EIB and konnex organization history

Konnex was created in 1999 and has its headquarters in Brussels (Belgium). It was formed by the merger of three European firms working on the development of new technologies electrical installation solutions that are intelligent Belgium's EIB organization in front of the EIB European Home Systems, BCI from France, which invented the Batibus system the Netherlands' EHS system is represented by this organization. Konnex was made up of a group of people when it was founded.

By the end of 2003, the group had grown to over a hundred members. These are still used today,WERK II, Werke GmbH & Co. KG, and many others.

www.konnex.org has a complete list of Konnex members.

CENELEC accepted the KNX standard as a European standard for electrical installations used in construction under the EN 50090 standard at the end of 2003. The KNX/EIB cable is designed for use in KONNEXTM KNX systems, which were previously known as EIB.

The KNX/EIB cable which succeeds EHS, BATIBUS, and EIB, uses the OSI network communications protocol.

Intelligent building control software can help you save money while also helping the environment buildings.

3.4 Smart home network design based on KNX technology

The main key features of KNX are guaranteed compatibility of products from different manufacturers, a single software tool (Engineering Tool Software, abbreviated - ETS) for planning, development and implementation of a project, as well as official training and certification courses for specialists. From a technical point of view, the solutions allow for all popular automation scenarios, including lighting, climate control and security.

Figure 3.1 – Smart Home control

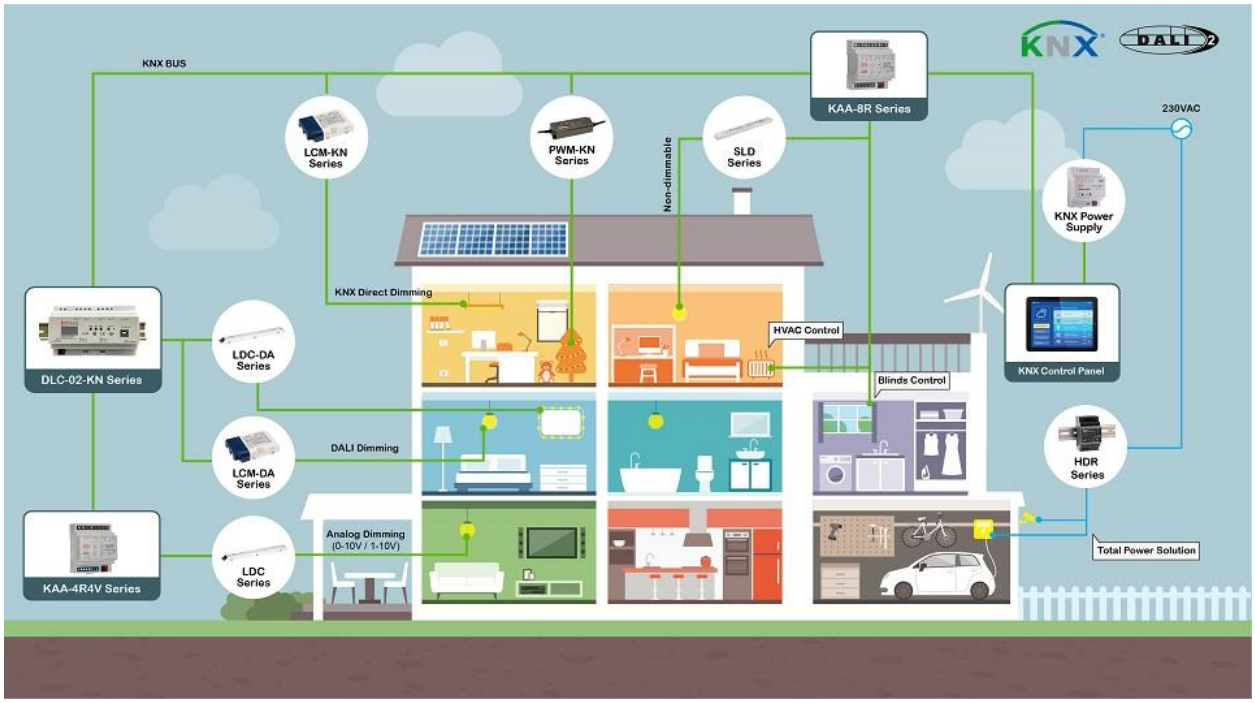

Figure 3.2 – Way to implement a smart home

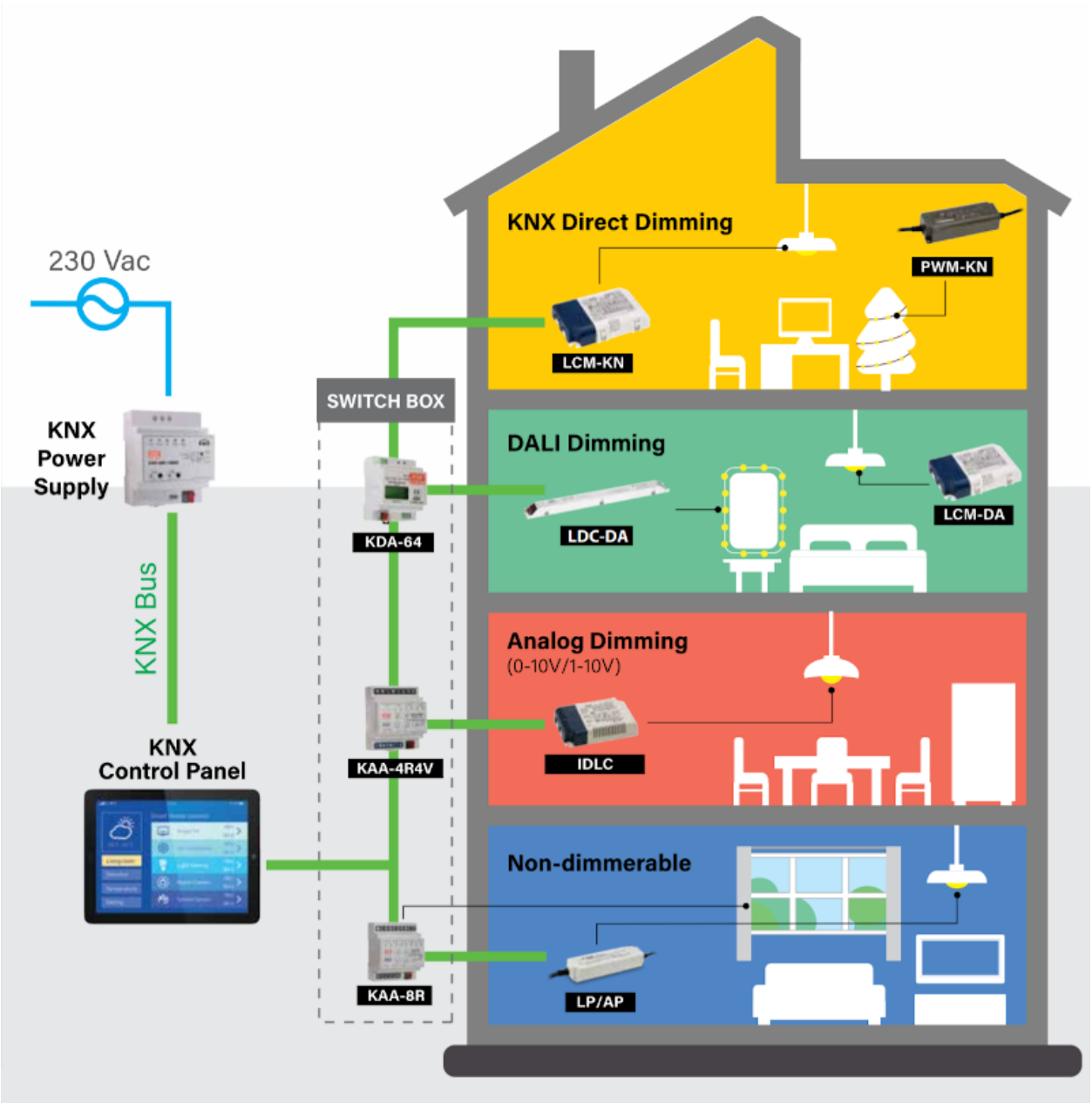

Figure 3.3 – Way to implement a smart home on KNX

KNX bus

The overwhelming majority of KNX projects are based on the use of a special dedicated wire bus (twisted pair), so the information in this material will refer mainly to this option. All controllers, sensors and actuators are connected to the wired bus. In practice, this means the need to develop a project and lay the necessary communications during construction or repair. Formally, there are other transmission media in the standard (in particular, the power supply network and radio communication), but they are relatively rare in projects.

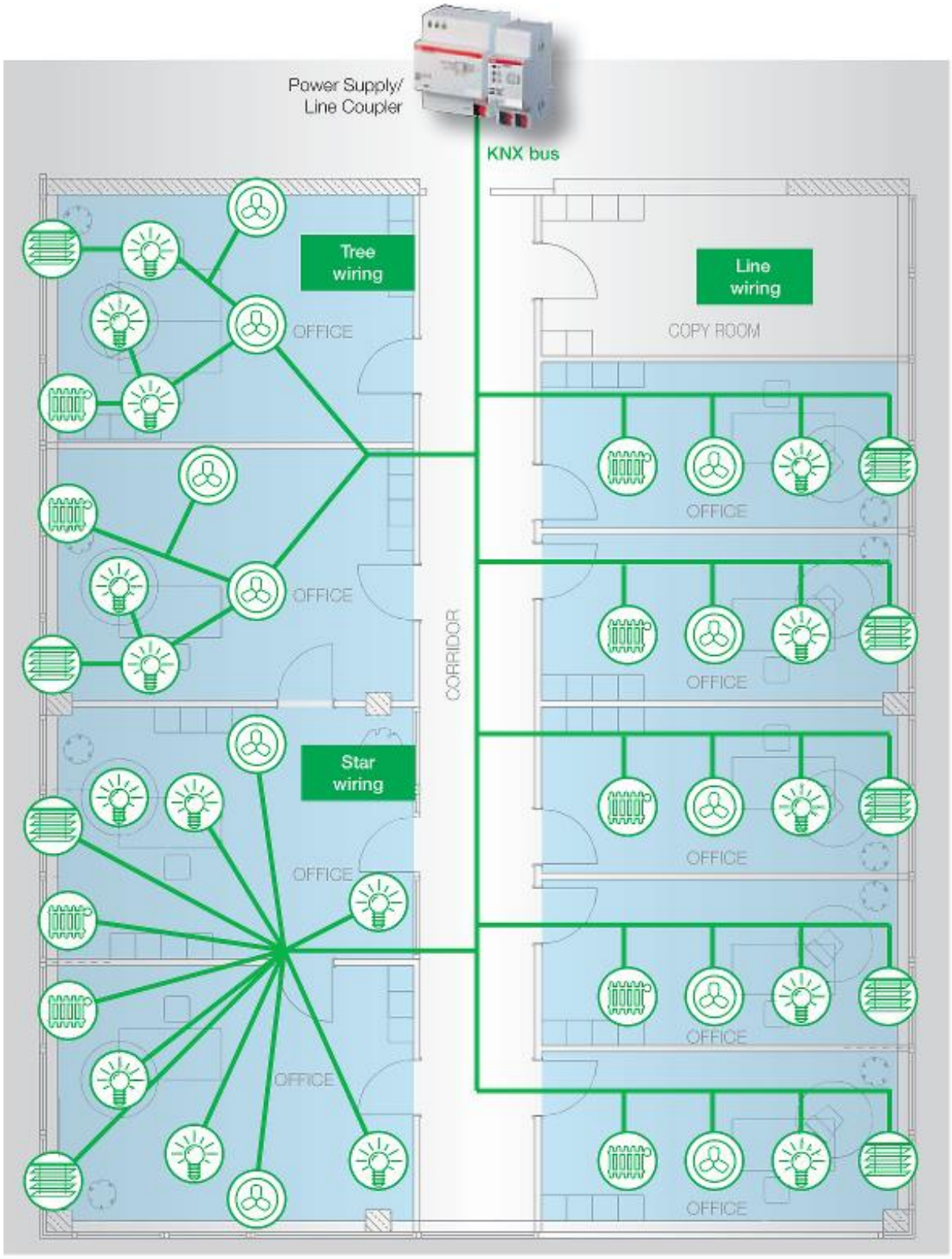

Figure 3.4 – Schematic representation of the KNX bus

As an alternative option, which does not require the laying of an additional control bus, schemes are often used with the output of all individual consumers to a common panel. Both versions have their pros and cons. At the same time, their

combination is also allowed, if the compliance with the KNX specifications is maintained.

The wired bus topology can be selected flexibly. The use of linear busbars, wood and stars is allowed. Termination is not required here, but it is recommended to pay attention to protection against overvoltage and thunderstorms. The basic element of the logical structure is a segment, which contains up to 64 nodes. Up to four segments can be combined into lines, which can in turn be combined into an area (up to 15 lines). At the highest level, up to 15 areas can be combined into a system. The total number of devices in one network is about 58 thousand.

It is recommended to use a 2x2x0.8 cable for the bus, although just one pair of data lines is sufficient for KNX operation. The second pair can be used to supply additional power (some devices can be powered from the KNX bus itself) or as a backup.

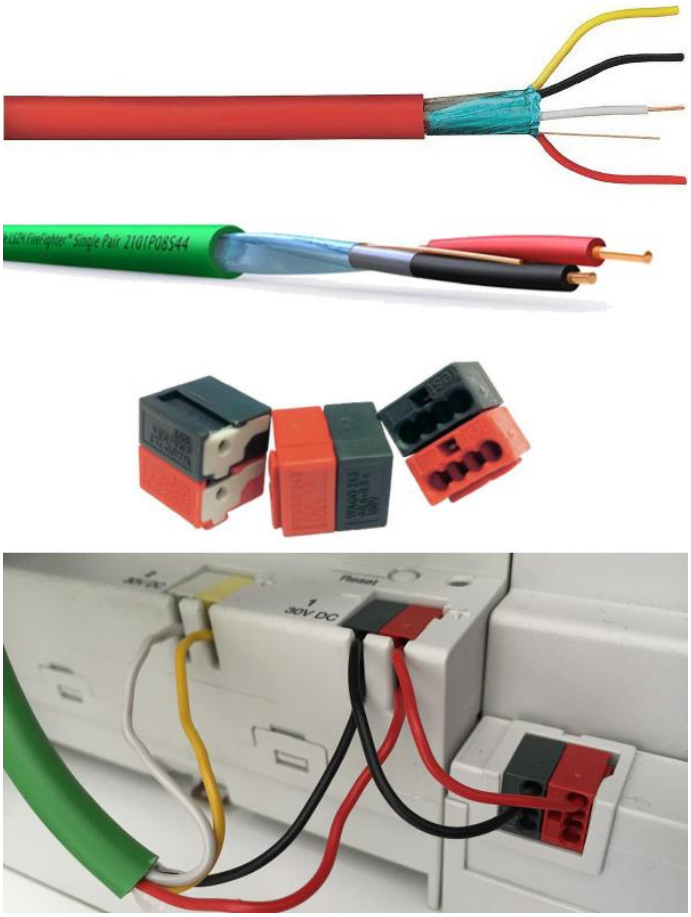

Figure 3.5 – Cables for the bus

Multiple power supplies can be used on a segment if required. Interestingly, the power supply has to withstand a power outage of up to 100ms, which increases the

reliability of the system. When creating a project, you have the opportunity to control the consumption of all devices on the line based on their characteristics provided by the manufacturer. The general characteristics of the tire are as follows:

maximum cable length in a segment - 1000 m;

maximum distance from the device to the power supply unit - 350 m;

the maximum distance between two devices is 700 m;

the minimum voltage on devices is 21 V.

To combine segments and lines, special connecting equipment is used, capable of performing the functions of repeaters, bridges, routers and packet filters. Usually, all these functions can be performed by the same equipment, and the actual algorithm of its operation is recorded at the time of programming. The next step in scaling the system is achieved through the use of bridging in traditional IP networks.

The interaction of devices on the bus occurs through the exchange of data packets. The exchange rate is 9600 bps, and CSMA / CA technology is used to handle collisions. The protocol describes all possible formats of information messages and data types of the variables used. In particular, the packet contains the addresses of the transmitter and receiver, the data itself and the checksum. The total packet length is usually less than 23 bytes. The transmission time is 20-40 ms. Responsiveness depends on the bus load and the number of devices in it. In the case of simple options for lighting control, the operation of the switches does not visually differ from direct control. But in large loaded networks, including those connected over IP, additional optimization operations may be required depending on the customer's requirements.

Provides a scheme for confirming delivery and resending in case of failure, some prioritization options. Interestingly, in addition to traditional binary, integer and text variables, the standard directly records formats for working with brightness, temperature, pressure, time, power and other information. The most popular command options and data types include changeover, drive control (include motion, stop, step), dimming (relative, stop, absolute value), and transfer of physical quantities (eg temperature).

There are no standard means for monitoring the status of devices on the bus. Some manufacturers provide the Heartbeat function in their products, but an external controller will need to process these signals.

Devices

The variety of devices of this standard can be assessed according to the catalogs presented on the websites of the largest manufacturers. In particular, the latest versions from ABB and Schneider Electric have about 200 pages, and from Gira - about 100 (part of the catalog on KNX solutions). Of course, this is a rather rough estimate, but it gives an idea of the manufacturers' interest in this product. Even one listing of possible groups of goods will take more than one line: relays (including control of curtains, blinds, gates), dimmers, buttons and switches, binary and analog inputs and outputs, sensors (movement, illumination, temperature, energy consumption, weather, water leakage, smoke, gas leaks), climate control (heating, ventilation, air conditioning), touch panels, bridges to other systems (IP, DALI, SMS, telephone, email, intercom, security systems), system components (power supplies, bridges, interfaces programming, controllers).

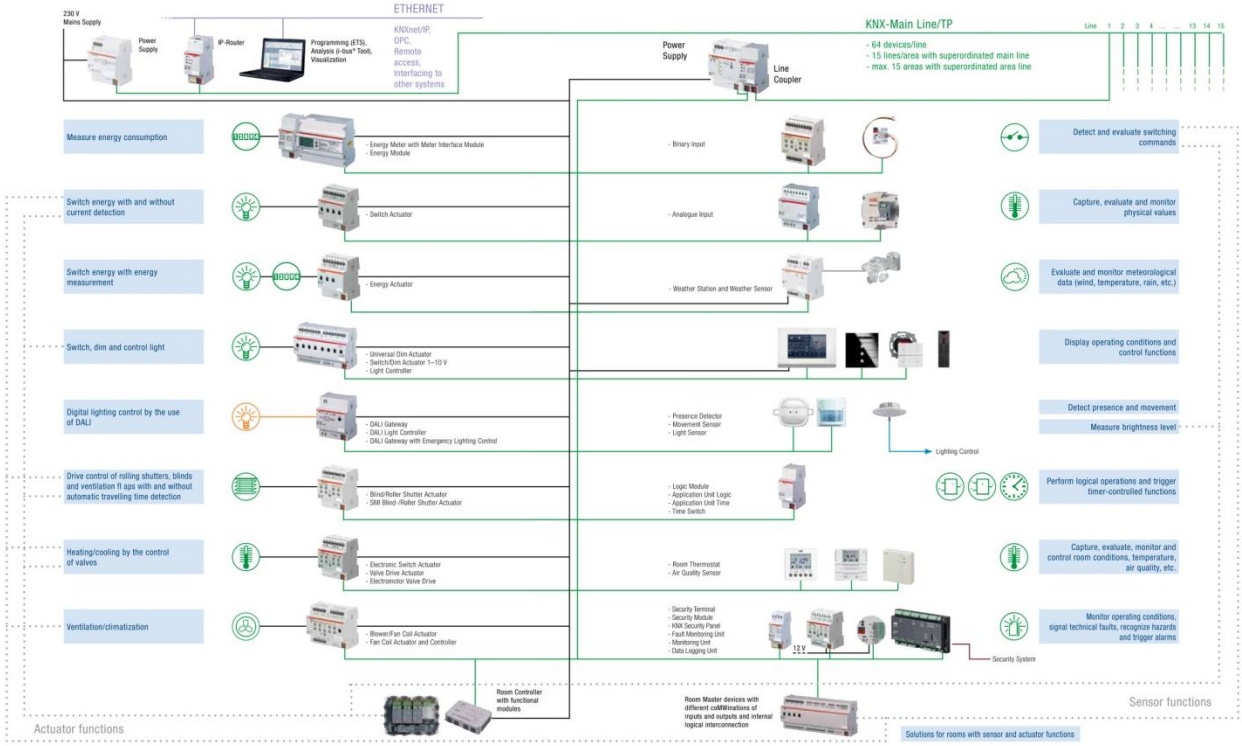

Figure 3.6 – Devices connection

In this case, the models can be both installed in standard junction boxes, and for mounting on a DIN rail. In the second case, devices for a large number of control channels are often used (in particular, relays and dimmers). Usually, devices are connected only to the KNX bus and directly to sensors or controlled devices; additional power is not required in this case.

All KNX devices are certified. For programming it is obligatory to have a configuration file corresponding to the device. It is usually downloaded from the manufacturer's website and integrated into the ETS program. In the same program, you can change the configuration of devices according to the scheme provided by the manufacturer. In particular, you can select the operating modes of switches and binary inputs, the speed of dimmer adjustment, and adjust the temperature in thermostats.

In the overwhelming majority of cases, devices include several objects, which are the minimum unit for participating in groups, receiving and sending messages, setting parameters and other elements of the project.

It should be noted that the flexibility of the technology allows the use of the same hardware devices to implement different functions, which is achieved by the ability to load different internal programs into them. An example is the transformation of a multi-relay unit into a shade controller.

Addressing and commands

The basic configuration of KNX projects can be considered decentralized - data exchange between devices is carried out directly, without the direct participation of any separate specialized controller. This approach has both its pros and cons, and it is necessary to consider the issue as applied to the specific tasks of the project. For example, in this way it is possible to implement an autonomous segment for controlling lighting in a house based on programmed scenes and algorithms. However, one must be aware that the devices themselves are relatively simple and, if necessary, more complex interaction algorithms will require the installation of an additional controller. The further description in this material concerns exactly the standard capabilities of the KNX protocol.

Device addressing typically uses an area-line-device scheme. The size of the address field is 16 bits. In this case, your own addresses must be registered in each

device at the stage of programming the system via ETS. Note that this operation requires physical access (usually - pressing a button on the case), and after setting the address, all operations can be performed remotely. These addresses can be changed later. In the latest generations, individual serial numbers have been added, which is more convenient for programming, and additional protection for remote read-write device data (4-byte code check).

Group addresses are important logical elements of the system. They are functionally assembled devices. In this case, a sensor / sensor (for example, a button) can send commands to only one group, and actuators (for example, relays) can receive information in several groups at once. Note that all devices in a group must have the same data type. For example, you cannot link the sending of a binary signal from a switch for dimming. However, it often happens that the same device can send or receive data of different types, which can help in this situation. For example, a dimmer can provide an interface for several group objects and understand commands to turn on / off, increase / decrease the brightness and set the target brightness as a percentage.

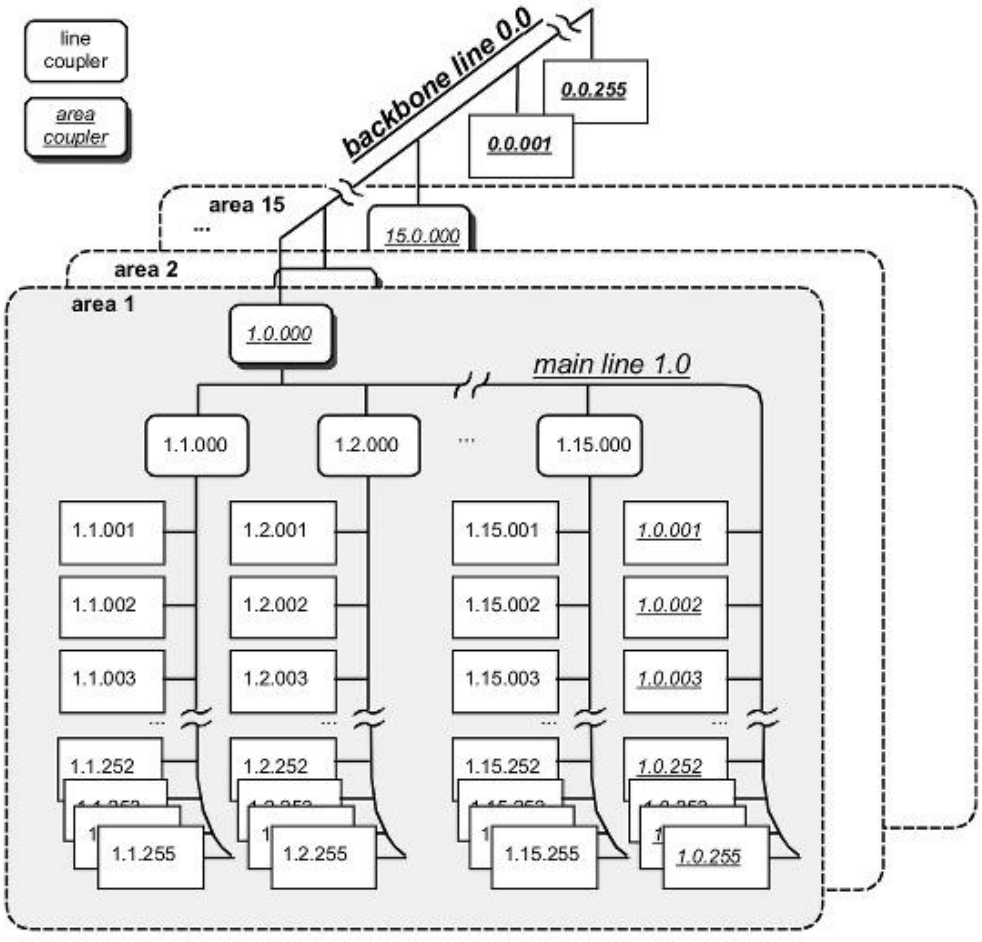

Figure 3.7 – The logical topology of KNX

Using such a scheme allows for simplified management of a group of devices by sending a single message to a multicast address instead of unicast. Limits on the maximum number of multicast addresses are usually individual and are specified in the hardware specifications. To simplify the structure, you can split group addresses into specific categories. For example, according to the "floor-room-lighting" scheme. The group field size is also 16 bits.

Note that in addition to directly sending commands to executive devices, other types of messages are also provided, for example, receiving a status. In particular, in this way it is possible to realize the preservation of individual control of the lamp with one button (pressing causes switching) with the simultaneous participation of this light source in the scene.

Here it is worth paying attention to the fact that the scheme does not provide for any programs, including logical actions, checking conditions, delays, cycles and other operations. Sometimes there are devices inside which there are basic logical operations, as well as models that can act as external logical blocks for several operations (for example, comparisons).

Controllers are a separate class of devices. They are equipped with their own processor, KNX bus adapter and other interfaces. There are no restrictions here, everything is determined by the developer. These devices are capable of performing many additional operations, including working with timers and time, scenes, checking logical conditions (for example, according to the state of sensors), interacting with external devices and other systems.

Programming

All programming of the KNX system is carried out in the ETS program (Engineering Tool Software). This ensures the unification and compatibility of solutions from different manufacturers.

The working document in it is the project. In this case, you can use several projects in one network (for example, in a large building) or several networks with one project (for example, in the same type of hotel rooms). Direct work with the project does not require access to the installation, however, to download the configuration and

diagnostics, of course, you will need to connect to the KNX network. This operation is carried out either through local (USB or RS-232) interfaces or an IP bridge.

The program works only with Windows operating systems, the interface is in several European languages, there is no Russian version (however, it can be used in device configuration files). The free version allows you to train on projects from five devices, while full-fledged work requires compulsory licensing using a USB dongle. The cost of the latest version at the time of this writing was € 200 for the Lite version (up to 20 devices) and € 1000 for the Professional version, which has no restrictions.

In general, the process of programming an automation system consists of several steps:

Creating a project file;

Importing information about used devices into the program directory;

Creation of the structure of the building;

Adding devices from the catalog to the project;

Selecting addresses, setting parameters, adding comments for devices;

Creation of a structure of group addresses;

Distribution of devices to group addresses;

Uploading the project to the automation system;

Performance check, diagnostics.

When creating a project, you need to pay attention to the choice of the bus type, as well as the address organization scheme. In particular, for small projects, you can work with two-level addressing, and for large projects, it may be more convenient to implement in the form of three levels. When preparing this material, the second option was used.

As we said above, for the successful programming of the device, it is necessary that the catalog contains its description in a special format. These configuration files are provided by the manufacturer, or you can use the electronic catalog built into the ETS software.

In the case of using some types of "complex" devices, the logic of work with which does not fit into the capabilities of the ETS software, the manufacturer offers

additional utilities for working with them, which are integrated into the main shell of the program.

When creating a building structure, it is envisaged to use such elements as floors, stairs, rooms, corridors, and wardrobes. Next, you use the devices from the catalog to place them on the resulting building structure. This allows you to conveniently create almost any configuration, which helps to simplify further work on the project. Of course, one must understand that, in the general case, such a division is in a sense conditional, since there may not be any physical binding of devices to rooms (for example, in the case of a centralized scheme). However, from the point of view of maintaining order in the project, especially if several employees are working on it, it is very useful to think about this moment in advance.

It should not be forgotten that from the point of view of the KNX bus and direct physical connections, the project has its own topology, which is different from the logical structure of the building. There are areas on the upper level, lines are present in them, and devices are already connected on the lines.

In many cases, the setting of device addresses can be trusted by the program. If necessary, they can be changed in the future. Before proceeding to the next step, it is necessary to check the configurations of all used devices, as they depend on the scripts to be executed and the available functions. Here, for convenience, you can add comments.

Group addresses have their own logical structure, different from the building and topology. In doing so, you can use, in particular, the grouping by floor or by function. For a three-level scheme, additional division can be provided, for example, by room.

Further, at the lower level, the group addresses themselves are created and the required device objects are added to them. As we wrote above, it is important to observe the correspondence of data types here, as well as to configure the flags.

Note that up to this point, the installer did not need directly the devices themselves and a working KNX network to work on the project.

To load a project into an installed automation system, you will need to connect a computer to it using one of the supported interfaces. This interface is not required

directly for operation, but often it remains in the installation for the convenience of making changes to the configuration.

Loading the configuration into can be carried out in several modes, including full (addresses are also written in it, which requires pressing a button on each device) and partial (only configuration changes are recorded, since the addresses must already be registered, the system works with them and press the buttons no need).

Note that it is impossible to completely restore ("read") the project configuration file from a running system. So if you are a customer and are not sure of your installer, it is advisable to provide for the transfer of this data after completing the configuration.

And of course, do not forget that after completing the programming of the automation system, it is advisable to check its operability. ETS functions such as bus monitor and multicast monitor can be useful here. In the first case, it is obligatory to connect to KNX via bridges in RS-232 or USB, and control of group operations is also possible via IP.

3.5 Conclusion of the chapter 3

Eventually, in today's market economy, the smart home's savings are beginning to make a big impact. This award, on the other hand, emphasizes the protection of natural resources, which is a far more important component. After all, whatever was conserved by smart home systems ended up being maintained in nature, whether it was energy, mineral resources, vegetable raw materials, or anything else. One of the most important roles of a smart house is to preserve natural riches. Because humanity is closely related to and a part of nature, nature protected today will pleasure us tomorrow. Our children and grandkids, too. — sewerge.ru/en/the-project-is-a-smart-house-conclusion-how-to-make-a-smart-house-without-a-project/

CHAPTER 4
LABOR PROTECTION

4.1 Protection against electrical hazards in smart house

Ways to Prevent Electrical Hazards for smart home Appliances

"Make Sure Your Appliances Are Dry"

Water with electricity is one of the most lethal pairings. They might electrocute somebody if the electrical appliances become wet.

“Ensure the Safety of Your Electrical Outlets”

"If you have kids, they're bound to be curious at times." If they try to play with your outlets, they will be electrocuted. They may poke the outlets with their fingers or things such as forks. As an extra layer of protection, outlet covers can help to lessen the danger."

Turn off any appliances that may not be in use.

"If you use your electrical equipment for lengthy periods of time, they may overheat." Even if they aren't in use and are still plugged in, they can catch fire due to overheating or a power surge."

Leave the repairs to the professionals.

"It's tempting to save a few money by doing the repairs yourself. However, if you make a minor error, the consequences are more costly. If you're not an expert in electrical repair, you should leave it to the professionals."

Keep a safe distance from faulty products.

"There are a lot of fake items on the market." You must keep in mind that they are inexpensive for a reason. They are electrical risks since 99 percent of them do not follow electrical safety regulations."

Wet Hands Shouldn't Be Used

"Also, never work with an electrical item while your hands are wet." This dramatically increases your chances of getting an electric shock — hairdryers are the worst offenders, so keep them out of the bathroom and away from any sink, bath, shower, or faucet."

Exposed wires should be taped or replaced.

"Make sure the appliances' wiring is properly sealed. The first step in preventing a potential threat is properly insulated wiring. This is critical because exposed cables are more likely to come into contact with water or human contact, posing a hazard if not addressed promptly. Seal the aperture with PVC tape, or better yet, replace the wire with a new one for further safety."

4.2 Protective measuers against elctromagnetic fields and non-ionising radiation

Intensive development of electronics, radio and computer technology has caused pollution of the environment with electromagnetic radiation. Sources of electromagnetic fields (EMF) can be natural and anthropogenic.

Artificial radiation sources are powerful radio and television, radar stations, mobile communication stations, imperfect computers, high-voltage telecommunication lines, electric vehicles, power plants and substations, industrial high-frequency heating installations, measuring devices, microwave ovens, TVs, electric stoves, electric stoves, electric stoves. refrigerators, as well as any elements connected to the network.

Natural sources include: Earth, Sun, Space. The electric field of the Earth has an average intensity E = 130 n / m but lower at the poles, and the greater at the equator. These values change under the influence of solar activity, the energy of cosmic radiation. All living things adapted to these eternally existing fields and radiations.

Electromagnetic radiation of anthropogenic origin is considered as one of the types of energy pollutants because they negatively affect the human body, other living organisms and have a detrimental effect on ecological systems. EMFs have energy and propagate in the form of electromagnetic waves. The main parameters of electromagnetic waves are wavelength, oscillation frequency, speed of propagation. The measure of electromagnetic field pollution is intensity (V / m).

Factors that affect the effects of EMF on biological objects. The effects of EMF on humans.

The level of EMF intensity (Fig. 4.1) has now risen sharply due to the increase in the number of their sources and power. In some areas, it is hundreds of times higher than

the value of the average "natural background". Electromagnetic fields have a negative effect on people who work directly with radiation sources, as well as on people who live near radiation sources. The degree of influence of electromagnetic radiation on the human body depends on the frequency range, the intensity of the relevant factors, the duration of irradiation, the nature of the radiation, the irradiation regime, the size of the irradiated body surface and individual characteristics.

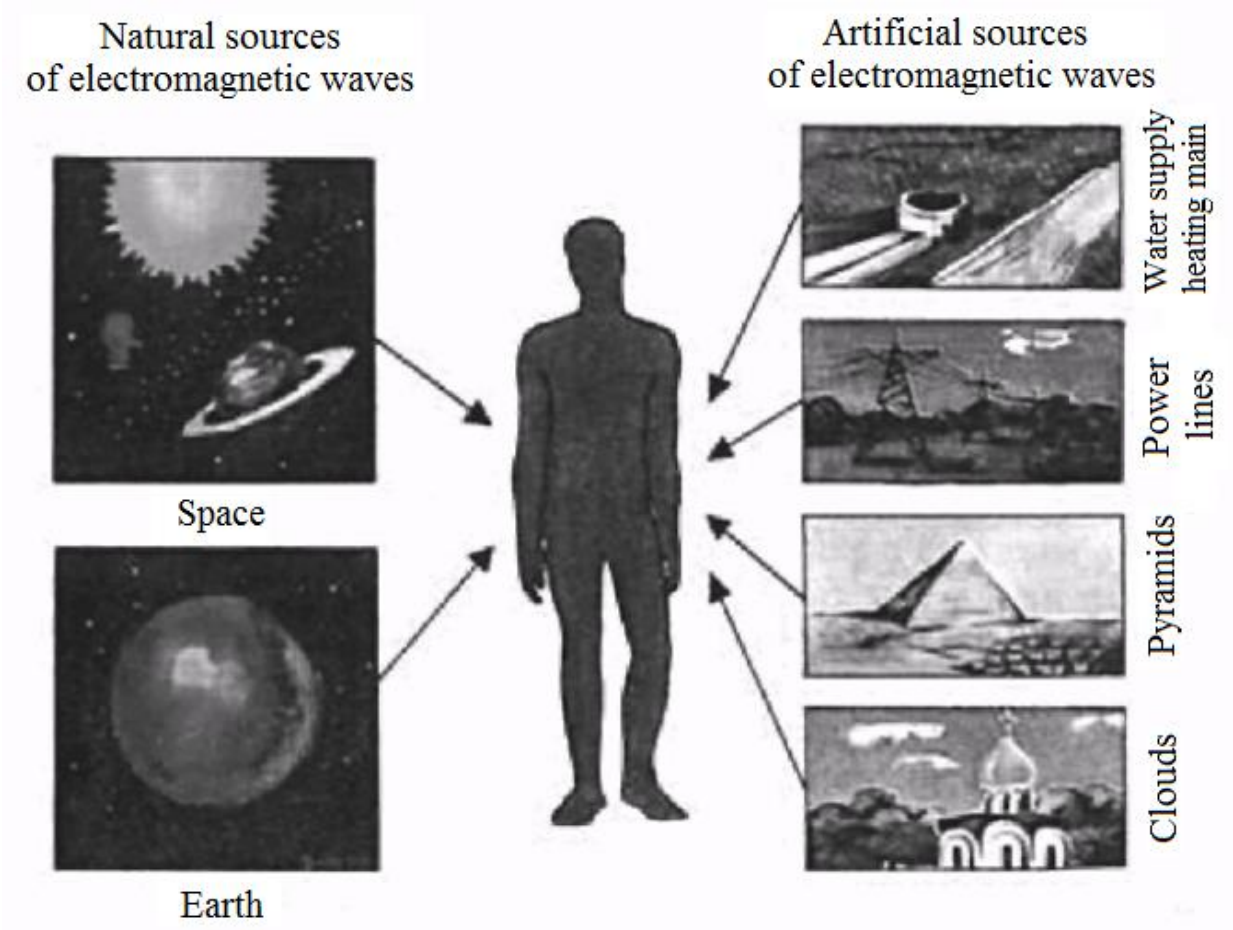

Figure 4.1 – Natural and artificial sources of electromagnetic waves

The level of electromagnetic radiation in areas where powerful radio transmitting and location stations are located often exceeds the permissible sanitary norms, which is very harmful to the health of people living near such stations. The effect of EMF is characterized by biological action. They damage the nervous system, cause headaches and severe fatigue, cause neurosis, insomnia, decreased accuracy of work movements, lethargy, disorders in systems and organs (stomach, liver, spleen, pancreas), functional disorders in the neuropsychological, cardiovascular, endocrine, hematopoietic systems, recorded changes in protein and carbohydrate metabolism, changes in blood

composition, recorded violations at the cellular level. The effect of EMF on biological objects depends on the intensity of irradiation.

Thermal action is characterized by a general increase in body temperature, similar to the idle state or localized heating of the tissue. By acting on the living tissue of the body, EMF causes variable polarization of molecules and atoms that make up cells, resulting in dangerous heating. Excessive heat can damage individual organs and the entire human body. Particularly harmful is overheating of organs such as eyes, brain, kidneys, etc. With increasing intensity, the effect on the nervous system, conditioned reflex activity, liver cells, increased pressure, causes changes in the cerebral cortex, vision loss.

To prevent occupational diseases that occur under the influence of EMF, sanitary norms and rules for radio and electrical facilities have been developed on the basis of medical and biological research. They also regulate the conditions of operation in order to protect the population from the harmful effects of radiation.

Various means and measures of protection are used to protect a person from electromagnetic radiation: protection by time, protection by distance, shielding of radiation sources, reduction of radiation directly in the radiation source, establishment of sanitary borders around the EMF source, shielding of workplaces, allocation of radiation zones, remote control and management in a shielded room, medical examinations, additional leave, reduced working days, use of personal protective equipment.

Radiofrequency electromagnetic radiation, ie those used for radio, television and mobile communication by wavelength are divided into: long waves, medium waves, short waves. Long waves are reflected by the ionosphere and the Earth and propagate between them. They encircle the earth's surface and all obstacles in their path. The middle waves propagate in the layer between the ionosphere and the Earth's surface. If their size is greater than the wavelength, they are reflected by these obstacles. Short waves are reflected from the ionosphere and the Earth and are strongly absorbed by the Earth. Reflection from the Earth's surface and ionosphere is used for their transmission. Ultrashort waves. All modern TV transmitters and mobile communication are currently operating in the ultra-short range. They are significantly absorbed by the Earth and the

atmosphere, and therefore for their further transmission requires repeaters that operate only in line of sight.

Protection from Non-Ionizing Radiation (NIR)

NIR program is intended to safeguard employees, students, and the general public against non-ionizing radiation's negative effects.

The NIR electromagnetic spectrum is divided into three categories:

Radiation of light - Microwave radiation (ultraviolet (UV), visible, and infrared) (300 GHz to 300 MHz)

Radiation of radiofrequency and lower frequency (300 MHz to Static Fields)

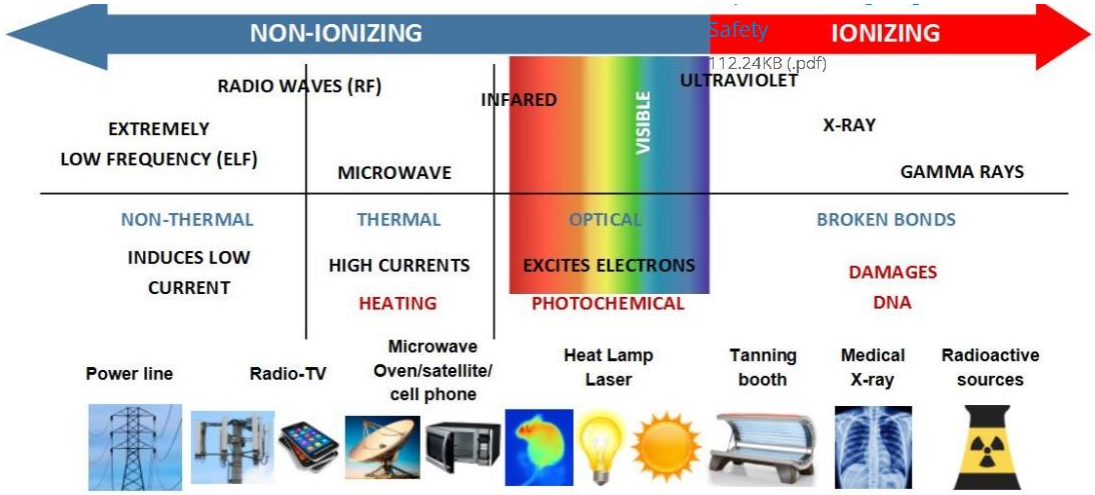

Figure 4.2 – The NIR electromagnetic spectrum

Personal protection equipment (PPE) should be given to laboratories that use UV equipment.

Gloves and long-sleeved garments to protect the arms, hands, and neck

A fixed magnet or magnetic flux produced by the passage of electric current produces static magnetic fields. The magnetic field becomes stronger as the current increases.

When an object consisting of ferrous materials, such as steel, is dragged fast toward a powerful magnet, it can become a projectile, resulting in a dangerous scenario or injury.

Liquid nitrogen and liquid helium are used as coolants in superconducting magnets to keep the magnet coils superconductive.

CONCLUSION

We've gained a lot of knowledge about smart home technologies.

We discussed net structures, modules, topologies, communication medium, addressing, and softwares in general, before focusing on Konnex, a well-known, stable, and dependable smart home system standard.

We now have everything we need to write a project, including the ability to consider every issue that has to be considered, from the initial step of planning and interacting with clients to the last phase of maintenance and future advancements.

Every project is unique, and you must be aware of this at all times. However, they all contain the identical instructions for everyone. All subsequent parts of the project will be easier, and the project itself will be easier if you spend the time at the start to accurately describe the goal and develop correct documentation.

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