VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ

Fakulta elektrotechniky
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BAKALÁŘSKÁ PRÁCE

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VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ

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ANALÝZA NOVÝCH TECHNOLOGIÍ ZOBRAZENÝCH V SERIÁLU BLACK MIRROR/ČERNÉ ZRCADLO A JEJICH DOPADU NA SPOLEČNOST

ANALYSIS OF FUTURE TECHNOLOGIES AND THEIR IMPACT ON SOCIETY AS PRESENTED IN THE SHOW BLACK MIRROR

BAKALÁŘSKÁ PRÁCE
BACHELOR'S THESIS

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POKYNY PRO VYPRACOVÁNÍ:

Cílem práce je analyzovat realističnost a proveditelnost vybraných technologií vyobrazených v seriálu Black Mirror. Seriál Black Mirror (2011-2019) předkládá dystopickou vizi budoucnosti lidstva a jeho vztahu k novým technologiím a nutí diváka zamyslet se nad (nejen) společenskými důsledky nezadržitelného pokroku v této oblasti. Součástí práce by tudíž měl být i komentář k etickým otázkám, které se k budoucnosti vývoje IT technologií vážou.

DOPORUČENÁ LITERATURA:

Irwin, William, and David Kyle Johnson. Black Mirror and Philosophy: Dark Reflections. Wiley-Blackwell. 2019.

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ABSTRAKT

Tato bakalářská práce je zaměřena na popis robotů a sociálních sítí z vybraných epizod seriálu *Black Mirror*. Stručně se zabývá popisem děje a poselstvím jednotlivých dílů. U každé vybrané epizody se zejména zaměřuje na technickou proveditelnost daných technologií. V této práci jsou roboti a sociální sítě ze série *Black Mirror* srovnávány s moderními ekvivalenty ze skutečného světa. Práce rovněž pojednává o výhodách a nevýhodách sociálních sítí a robotů, včetně jejich vlivu na naši společnost. Dále se zabývá etickou a sociální stránkou těchto technologií. Hlavním cílem bakalářské práce je poskytnout vhled do technologií použitých v seriálu *Black Mirror*.

KLÍČOVÁ SLOVA

Black Mirror, Roboti, Sociální média, Umělá inteligence, Chatboti

ABSTRACT

The bachelor thesis is focused on the description of robots and social media from selected episodes from the television series *Black Mirror*. It briefly deals with the description of the story and the message of selected episodes. For each selected episode, it focuses mainly on the technical feasibility of the depicted technologies. In this work, robots and social media from the *Black Mirror* are compared with modern equivalents from the real world. The bachelor thesis also discusses the advantages and disadvantages of social media and robots, including their impact on our society. It also deals with the ethical and social aspects of these technologies. The main aim of the bachelor thesis is to provide insight into the technologies used in the *Black Mirror* series.

KEYWORDS

Black Mirror, Robots, Social media, Artificial intelligence, Chatbots

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Prohlášení

Prohlašuji, že bakalářskou práci na téma *Analýza nových technologií zobrazených v seriálu Black Mirror/Černé zrcadlo a jejich dopadu na společnost* jsem vypracoval samostatně pod vedením vedoucí bakalářské práce a s použitím odborné literatury a dalších informačních zdrojů, které jsou všechny citovány v práci a uvedeny v seznamu literatury na konci práce.

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V Brně dne …………………………….   …………………………………
                                                              Miloslav Kaplan

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Introduction

Black Mirror is a dystopian sci-fi television series created by Charlie Brooker. Netflix purchased the *Black Mirror* in September 2015 when it had 12 episodes and divided them into two seasons. To date, five series have been released on Netflix. *Black Mirror* was inspired by older anthology series such as *The Twilight Zone* or *Tales of the Unexpected* (*Black Mirror).* In *Twilight Zone* was debated controversial issues that were place in fictional settings. Brooker applied this idea to modern problems such as virtual reality, robots, and social media. This TV show examines the impact of technology and modern inventions on society. Diverse alternative realities make viewers ponder on the unexpected consequences of technology development. It mostly shows a dystopic vision of the future. *Black Mirror*, as the name of the show, represent screens of devices. These ubiquitous screens surround everyone not only in the show, but also in real life. This bachelor thesis will describe the negative and positive aspects of technology. Specifically, the bachelor thesis focuses on robots and social media, and outlines how they are depicted in the *Black Mirror* series. An important part is an effort to answer whether it is possible to achieve similar technology in the real world. The description will also focus on social and ethical issues connected to technology.

Watching *Black Mirror* is exciting and makes viewers think about individual technologies. Is progress in the field of technology good, or is it bad? Can it be harmful or useful? All these questions arise while watching this show. On the one hand, in a hundred years people may watch *Black Mirror* and laugh. It may seem nonsense to them in the future. They might ask questions like: "How could anyone even think that the future would look like this?" On the other hand, some technologies may look like these which were in the show. Science fiction, with its inventions, often predicts the future. The submarine, the flip phone, electric cars-these inventions appeared in books before anyone made them.

The first part of the bachelor thesis is aimed at the robots and their depiction in the episodes *Metalhead, Be Right Back* and *Hated in the Nation*. The plot of each episode will be described, and the used technologies will be compared with the real ones. Important aspects of robots, such as the feasibility of them, will be discussed. This part of the bachelor thesis focuses not only on the general description of robots, but also on the social and ethical aspects associated with them. In addition to robots, related topics will be briefly described, including artificial intelligence and chatbots.

Nowadays, some people cannot imagine their lives without social media. The second part of the bachelor thesis will focus on this topic, and it will be compared with the episodes *Hated in the Nation* and *Nosedive*. The plot of each episode will be briefly described at the outset, and

the social media used in these episodes will be later compared with real social media. Possible problems with social media, such as addiction, will be discussed. This part of the bachelor thesis will also focus on the social and ethical aspects associated with social media, because it is a hotly debated topic.

Chapter 1: Selected episodes

This part of the paper describes particular episodes of the *Black Mirror* series. The creator of the series, Charlie Brooker, wrote them all, and these episodes were chosen because they show the used technology well. Selected episodes are *Metalhead*, *Be Right Back*, *Hated in the Nation*, and *Nosedive*. These episodes are standalone, and they are placed in different alternative futures.

1.1 Hated in the Nation

This episode is about the world where bees, for an unknown reason, gradually became extinct. This extinction of bees might have catastrophic consequences for the flora of this world. The Granular company created Autonomous Drone Insect (ADI) to prevent the extinction of the flora. ADI's main purpose is to pollinate flowers and crops in the absence of honeybees.

This episode features detectives trying to investigate the cause of death of several victims. During the investigation, they discover that these deaths are caused by ADI's and that it is not a malfunction but a targeted attack. Victims are chosen according to the hashtag #DeathTo and their name on social media. The person with the most hashtag dies every day. ADI's commit this murder by flying into victims' brain. Anyone with ADI's in the head is in agony and eventually dies.

The story ends with a moral lesson, because everybody who used #DeathTo and caused someone's death is at the end killed by ADI's.

1.2 Metalhead

The episode is filmed entirely in black and white. It takes place in the world after an unexplained collapse of human society. The episode has a simple plot. It follows the story of Bella, Anthony, and Clarke, who are trying to steal a package from a warehouse. It has been known since the beginning of this episode that they go there because of Jack, who is dying. The problem is that the robotic dog guards the warehouse. This dog kills Anthony and Clarke and hit Bella with shrapnel that contains a tracker. Despite Bella's effort to save herself, she gets eventually caught by the dog. She manages to shoot it, but the robotic dog releases a final shell showering Bella with more shrapnel with trackers.

Later, viewers can see that more robotic dogs are going after her. She is desperate and speaks into a walkie-talkie to say goodbye to her loved ones. She put a knife to her throat and eventually commits suicide because there is no chance of survival. The last shot of the camera shows what they wanted to steal. Dozens of teddy bears are spilt on the ground. That means Bella, Anthony and Clarke died because they wanted to cheer Jack with this gift before he dies.

1.3 Be Right Back

This episode tells the story of Martha, whose boyfriend Ash was killed in a car accident. After discovering she is pregnant, she tries the online service that let people stay in touch with the deceased. This software is able to imitate a dead person by collecting all data from past online communications and social media profiles. Martha uploads their videos and photos, and begins to talk with artificial intelligence over the phone. As she communicates with the new virtual Ash, she becomes addicted to it. She shares all aspects of her life, such as her child's heartbeat, with this artificial intelligence. So even though the pain of loss is less than it was before, the dependence on AI is deepening.

Later she buys a synthetic body. It is built on the basis of Ash's physical characteristics, and it looks almost exactly like Ash. Despite the similarities with her past boyfriend, she is uncomfortable and struggles to accept its existence. She becomes frustrated because of the absence of certain habits and a lack of emotions.

At the end of this episode, the humanoid is unwanted, and Martha locks it in the attic. In a scene that is set in a time a few years later, viewers can see Martha, who allows her daughter to see the android, but she must force herself to join them.

1.4 Nosedive

Nosedive tells the story of Lacie Pound, who lives in a world where anyone can rate other people on social media on a scale from one star to five stars after any interaction. This rating affects everyone's socioeconomic status.

Lacie Pound is a character who is obsessed with rating. She has a rating of around 4.2. and wants to live in an exclusive estate. The problem is that anyone who wants to live there must have a rating of 4.5. or above. Her friend Naomi, who has a rating of around 4.8, asks Lacie to

become her maid of honor, which Lacie accepts. She intends to get a better rating through the wedding, because the evaluation of higher rankings has a greater effect on the rating.

The day before the wedding, Lacie goes to the airport to catch a plane. Unfortunately, people rate her negatively, and her rating drops under 4.2. Her flight is cancelled, and because of her rating, she cannot buy a new ticket. After disagreements with security, her rating falls under 3 stars. Later, she decides to rent a car. Due to the low rating, she can only rent an old car. This old car discharges during her way to the wedding, and she cannot find a suitable charger for it. Lacie is forced to hitchhike, and the only driver who stops is Susan, whose rating is 1.4. Surprisingly, despite her rating, she is very kind.

The next day Naomi calls Lacie and tells her to not come to the wedding because of the rating, which has dropped under 3 stars. Lacie gets drunk and sneaks to the wedding. She takes the microphone and starts her prepared wedding speech. During the speech, she becomes very aggressive and even grabs a knife. Guests rate Lacie negatively, which causes her rating to drop below one star. Later she is taken to prison. There she sees a man in the opposite cell. Without fear of being ranked down, they both start to insult each other. Lacie finds herself surprisingly happy exchanging insults with the other prisoner.

Chapter 2: Robots

This chapter aims at the robots from chosen episodes. It describes the skills of these robots, the possible future and comparing them with already existing technologies. Technological devices are examined from different perspectives. This chapter depicts the technological and ethical view of technology. The advantages and disadvantages, that can occur, are discussed. The technical part is important because it can inspire scientists to create something new. Furthermore, possible future problems with robots, such as feasibility or addiction, are discussed in this chapter.

The word "robot" originates in the fiction play *R.U.R*, which was written by Karel Čapek. R. U. R stands for Rossum's Universal Robots. In this play is an artificially created person. This person works in dangerous industries instead of human beings.

A robot is an automatically operated machine designed to accomplish a given task. There are many classifications of robots. These classifications are based on the ability to sense surroundings, movement, or way of using robots. How long each robot is able to operate depends on its power supply. It might be powered by mains or have a battery. An important aspect is a program or artificial intelligence which control robots. This AI and physical components determine what this robot can do, and then establish how each robot is used. The downside of using robots is their maintenance. Periodical checks and repairs are not cheap. In the article *Researchers Are Developing Shape-Shifting Fluid Robots,* Choi (2016) writes that conventional robots are made of rigid parts that are vulnerable to bumps, crapes, twists (Choi, 2016). Soft robots can resist many kinds of damage. Scientists from around the world are developing these soft robots, which are crated from soft, elastic rubber or rubber. Worms, starfishes, and octopuses inspire robots with a soft body. This shows that nature can inspire scientists when they develop new technologies. Several companies are working on the different improvement of robots. The result of their work can be seen today, for example in the field of transport, medicine, or industry. Consequently, the application of robots might be even wider in the future.

Nature also inspired a robotic dog from *Metalhead*, a humanoid from episode *Be Right Back*, and ADI's from *Hated in the Nation*. The advantages of nature-inspired robots can be translated into real life. For example, insect-inspired robots have the potential to be used in crop pollination, rescue missions, and environmental monitoring. Mechanical dogs can work as delivery machines. Built of humanoid robots resemble a human person. They have a body, legs,

and a head. For instance, they can be used for housework like it was mentioned in the episode *Be Right Back.* Even though scientists will need better materials and design to create insect drones, like in episode *Hated in the Nation*, the robotic dog from episode *Metalhead*, and the humanoid robot like in episode *Be right Back*, they already exist on a certain development level.

2.1 Robots in Black Mirror

2.1.1 Hated in the Nation-Insect-scale robots

In episode *Hated in the Nation* is used Autonomous Drone Insect. It is referred to by its acronym ADI. ADI's were created by the fictitious company Granular in response to the forthcoming extinction of honeybees. Their main purpose is to pollinate flowers and crops in the absence of honeybees.

The ADI's are powered by solar energy, and they are autonomous. The number of drones is too large, so it is impossible to control them individually. They are equipped with a basic virtual sensor to recognize the shapes of their surroundings. Also, they have military-grade encryption, so theoretically it is impossible to hack them.

Reproduction of ADI's takes place in hives where they congregate. These hives are equipped with a 3D printer which allows ADI's to replicate themselves and maintain the number of these drones on the required level. Also, ADI's can create another hive and thus spread all around the country. The Centre of control can search or check hives because they are connected to the internet. All drones can be controlled in this way. Also, it is possible to play records of the movement of individual ADI or see it online.

For Granular to be allowed to manufacture and operate ADI's, the government demanded to be able to exploit the drones for population surveillance. ADI's classified facial recognition technology has been used to track potential terrorists. In this particular episode, ADI's killed many innocent people. The technology of facial recognition was misused, and it was used to identify selected victims.

2.1.1.1 Comparison with existing technology

ADI's (see Figure 1) were created in episode *Hated in the Nation* as an alternative to honeybees, and their appearance resembles a real bee. Even though a bio-inspired flapping-wing flight is an area of interest for scientists today, fixed-wing drones are more spread. Company Coptrz is an expert in the field of commercial drones. On their websites, they explain the function of fixed-wing drones. "A fixed-wing drone has a rigid structure which generates lift under the wing due to forward airspeed. This is produced by either an internal engine or electric motor-controlled propeller. They will require either a handheld or runway take-off and can fly continuously over long distances as opposed to hovering" (*What is a fixed-wing drone*). The reason why they are spread is their design. Fixed-wing drones do not require much energy needed to propel them forward, which means they can fly for a long time. Another advantage is that they can fly at high altitudes, making them suitable for agricultural or environmental monitoring. Also, these drones are fast and can carry multiple payloads, which is convenient, for example for pipeline survey (Smith, 2020).
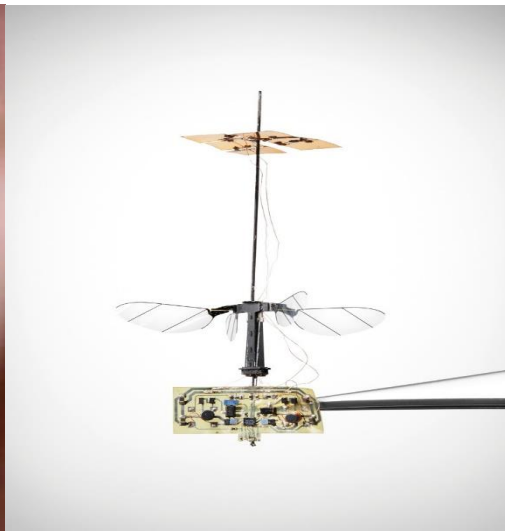
Figure 1. ADI   *Figure 2. RoboBee*

So why are scientists interested in flapping-wings robots? Breuer (2019), in his article *Flight of the RoboBee*, explains that although fixed-wing drones are popular, flapping-wing robots have potential advantages over them. Unlike fixed-wing drones, flapping-wings can make machines highly agile and maneuverable. Flapping-wings drones can fly ease, for example, through dense forest. Also, flapping-wings drones are quieter and cause minor damage in case of collisions (Breuer, 2019).

Breuer also elucidates the problems connected to flapping-wing robots. "Achieving robotic flight at the insect scale presents three specific challenges. First, the materials used to build the robot must be strong, yet lightweight. Second, human-engineered actuators and batteries are still far from realizing the power and energy densities, respectively, of biological tissue. And third, the sensing and control algorithms that animals routinely use to maintain steady flight and to maneuver are mind-bogglingly complex" (Breuer, 2019).

Jafferis et al. (2020) published a paper called *Untethered flight of an insect-sized flap-ping-wing microscale aerial vehicle* in the science journal Nature. This paper describes the lightest insect-scale aerial vehicle that has achieved the longest sustained untethered flight. This insect-scale robot is called the RoboBee (see Figure 2). Jefferies' team had to overcome mentioned challenges like weight, actuators, or batteries.

RoboBee flight system weights 259 milligrams with additional payload capacity. It consumes only 110-120 milliwatts with the thrust efficiency of a bee. (Jafferis et al., 2020). The downside is that the free-flying of RoboBee is impossible with current technology. Solar panels are not efficient enough for these purposes. RoboBee is capable of flight only in laboratory conditions. It is a huge disadvantage, but it can be overcome with batteries development. "The core of the RoboBee is a flapping-wing system made of composite material and constructed using a process known as laser machining. The current design of the flapping-wing system uses an innovative four-wing configuration that wiggles back and forth. This motion is driven by integrated piezoelectric and generates sufficient lift with acceptable power demands" (Breuer, 2019). So, for functional insect-scale robots were used innovative design methods, a flying system, and a power source.

ADI's have many advantages over RoboBee. Even though both are solar-powered, the ADI's can fly longer and farther. Other advantages are that they are autonomous, capable of self-replication, equipped with facial recognition and can pollinate flowers. To achieve this level of development is impossible for scientists with current technology. RoboBee outlines the possibility of modern technology, but there is still much work to be done to reach ADI's level. Several problems remain unsolved. These problems include, for example, weight or battery technology. The ultimate goal of this project is to make colonies of fully autonomous and wireless RoboBees (Jafferis et al., 2020). This idea is very similar to what we could see in the episode *Hated in the Nation*.

2.1.2 Metalhead-Quadruped robots

In the episode *Metalhead* is used the robotic dog that resembles a real dog in build. It is a robotic quadruped equipped with several lethal weapons, which make this dog a brutal and efficient killing machine. It is armed with explosive tracking devices, a build firearm, and a data probe. The use of the dog in this episode is for the protection of the warehouse. This robotic quadruped is a very durable machine and has solar charging. The equipment of this dog includes sensors that help it to perform tasks. These sensors are visual and sound. Additionally, these robots are able to track the source of radio waves and victims with thermal vision. They can run faster than a car, and they have advanced artificial intelligence that can make the best decision during the performance of a given task.

2.1.2.1 Comparison with existing technology

Boston Dynamics is an American robot design company. They develop highly mobile robots that resemble dogs, and they are leaders in this field. For this reason, their product is suitable for comparison with the robotic dog from the *Metalhead* episode. The individual models are described on their websites. The first of these robots is called Big dog, and in 2004 it was the first legged robot that left the laboratory. Later in 2007, Boston dynamics introduced a passively stable six-legged robot called RHEX, which has good mobility on rough terrain. In 2012 they designed a small robot called SANDFLEA, which is controlled as an RC car, but it can jump 10 meters into the air. Two models of quadruped robot followed in 2012 and 2013. These models were called LS3 and WILDCAT. WILDCAT was the fastest quadruped, and LS3 was designed as a carrier of load for soldiers. The latest quadruped robot, which is called Spot, was released in 2015. It is designed for outdoor and indoor operation. The Spot weighs only 25kg, and it is the lightest Boston Dynamics product (*Home | Boston Dynamics*).

The design of the robotic dog (see Figure 3) from episode *Metalhead* is very similar to the Spot's (see Figure 4). Both are robotic quadrupeds. Boston Dynamics on their website depict Spot, and they say it is not a house pet or a toy for entertainment. It is used to increase safety, productivity, and can carry and power up to 14 kg of inspection equipment. The Spot is powered from the mains and uses electric power to operate various electric and hydraulic actuators. It has an operating environment from -20C to 45C and possess build-in cameras that capture a 360-degree angle. An intuitive tablet application has been developed to control the robot. Programing languages C and C++ were used for the source code. The benefit of the Spot is that it allows programmers to develop custom applications for the Spot to do various actions. Usage

of it can be different, depending on the industry where it is applied. The Spot is available to developers for purchase for $ 74,500 and is ready to work as soon as it arrives (*SPOT®).*

Figure 3. The dog   *Figure 4. Spot*

The differences between the Spot and the *Metalhead's* dog are in their equipment and abilities. The *Metalhead's* dog is solar-powered, unlike the Spot, which is powered from mains. The battery of the robotic quadruped from this episode stays charged for a longer time, and it can automatically fast recharge from the Sun. The *Metalhead's* dog can connect and control digital technology, and it has a self-loading gun build in the leg. Controlling other digital technologies has not yet been possible for Spot. Other *Metalhead's* dog benefits are that it is way faster than the Spot, and it has more advanced sensors to perceive the surroundings. Even though the *Metalhead's* dog is a more advanced machine, the Spot is a sufficient opponent for it. The design of these two robots is almost the same. The Spot with guns could exist today, but the question arises as to whether handing over a weapon to a robot is acceptable or not. Nowadays, Boston Dynamics cannot compete with *Metalhead's* robotic technology in terms of endurance, speed, or AI. That level of development will require more advanced research and better materials.

2.1.2.2 Ethical aspect of the episode

Weaponry has always been a profitable business. Supervision of companies that have lucrative contracts to create dangerous machines, like the dog, which was outlined in this episode, is needed. The appropriate question is whether technology is a threat or whether it is a beneficial and useful tool. The answer to this question is not clear, and it depends on how people will deal with possible danger. Robots might be in future life-threatening, but also, they can be useful. The military already uses robotic dogs. Models of robotic quadrupeds like Spot are used in the military as a carrier, and they do not have a weapon.

Roboethics concerns with ethical problems connected to robots. It basically tells if robots might be harmful to humans now or in future. The first ideas of roboethics appeared in the first half of the last century. Isaac Asimov wrote a science fiction short story called *Runaround* (1942) in the magazine *Astounding science fiction,* where he created three fundamental Rules of robotics:

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.

2. A robot must obey orders given it by human beings except where such orders would conflict with the First Law.

3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

These laws follow basic principles as the majority of the ethical systems do. Any robot which follows those three laws is indistinguishable from a well-behaved person. Follow the rules might be a problem for people. For machines, it is not hard. Coleman (2016) in the article *Penn State Researchers Find Old People Are Terrified Of Robots* said, "Robotics is a technology that does not inherently have any good or bad effects to it. You could use a hammer to hit a nail, or you can use a hammer to hurt somebody" (Coleman, 2016). All that is needed to do is encode in a robot's memory that it cannot cause any harm to anybody.

2.1.3 Be Right Back- Chatbots and robots

In the episode *Be Right Back* are outlined technologies that try to help people who lost somebody close. The main topics of this story are humanoid and software that can replace the deceased.

Software from this episode is able to mimic a specific person. This imitation is based on insert online communication. This software creates a virtual person who can send text messages or make calls as a person whose communications have been uploaded to the cloud. The advantage of this software is that it can be transmitted into android. This transmission is based on former videos, chats, calls, and photos. Consequently, this android can seem and sound like the original person.

This episode shows that AI and robots can have a mental impact on people. The main protagonist of this episode was in a depression at the beginning of the episode. She interacts and chats with this software during the story, and eventually, it helps her to deal with sadness. On the other hand, this episode obviously shows that it can cause addiction because Martha could not be without this software for a moment.

2.1.3.1 Comparison with existing technology

2.1.3.1.1 Chatbots

Artificial intelligence (AI) is, according to Copeland (2019) "the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from experience. With the development of the computer, it has been demonstrated that computers can be programmed to carry complex tasks" (Copeland 2019).

Software used in this episode can mimic a specific person. It is based on former communication with this individual. This conversation simulating technology is called a chatbot. Chatbots simulates a conversation with people through text or voice messages. A real-life example of a chatbot is Alexa, Amazon's virtual assistant, or Mitsuku, which is described later. The idea of the chatbot is an easy way to find information without web search. It is advantageous for companies to use chatbots. The advantages of them are that they can ease call centres, and they are able to increase the number of served customers (Frankenfield, 2020).

Scientists wanted to define whether chatbots are intelligent. Turing test was created for this purpose by Alan Turing in 1950. It is a dialogue between a human and a chatbot, and as it was mentioned, it is designed to determine the intelligence of the machine. Chatbot Mitsuku was evaluated by this test and was close to passing it. Answers of this chatbot were natural; however, some answers were inaccurate.

The philosopher Luciano Floridi describes several questions and answers of this chatbot in his book, *The 4th revolution*. He asked several questions and analyzed Mitsuku's answers. On the question: "If we take each other's hand, whose hand am I holding then?" The computer replied by talking about something completely different: "We live in eternity. So, yeah, no. We don't believe." Another question was: "The four capital cities of England are three, Manchester and Liverpool. And the answer was: What's wrong with this sentence" (Floridi, 2016, p. 133)? Therefore, the computer did not answer these questions correctly.

Analysis of common sentences shows that it has a rich vocabulary. For example, on the question "What's the weather like where you are?" Mitsuku answered, "Here in Leeds, it is quite overcast. I think it will rain later (Link, 2020). It shows that Mistuku can lead a discussion on a general topic.

The software of humanoid Ash from episode *Be Right Back* is basically an advanced chatbot. Its purpose is to interact with other people. The difference between Mitsuku and Ash is that Ash can communicate in every situation, whereas Mitsuku cannot. Another difference is that Mitsuku, unlike Ash, is not a therapeutic tool, it only chats with other people on the internet. The main technology progress from this episode over the real world is the connection of advanced AI with a humanoid robot.

2.1.3.1.2 Humanoid robots

Humanoid robots resemble humans in appearance and behaviour. These robots are developed all over the world. Kajita et al. (2014) claim that Wabot-1 (see Figure 5), regarding its abilities, was the first humanoid robot in history (Kajita et al., 2014, p. 156). This robot does not look like a person, but it has two hands and two legs. Humanoid robots like Sophia (see Figure 6), developed by David Hanson, look more like a real person. And this similarity with human beings is one of the aims of scientists. At the same time, it is very important what a robot is able to do and where it can be used.
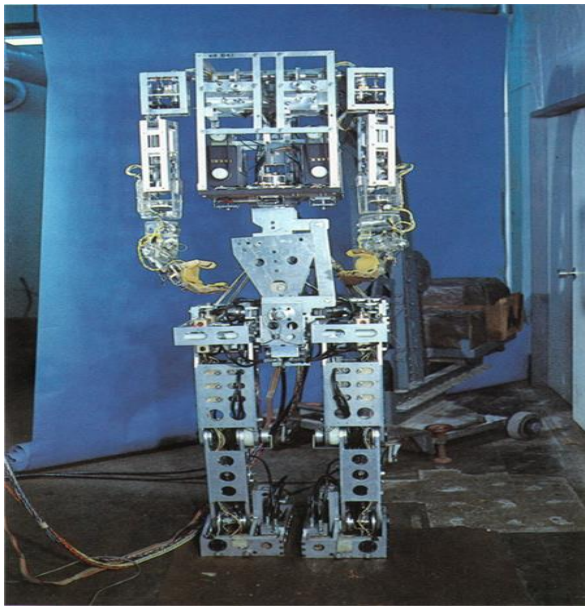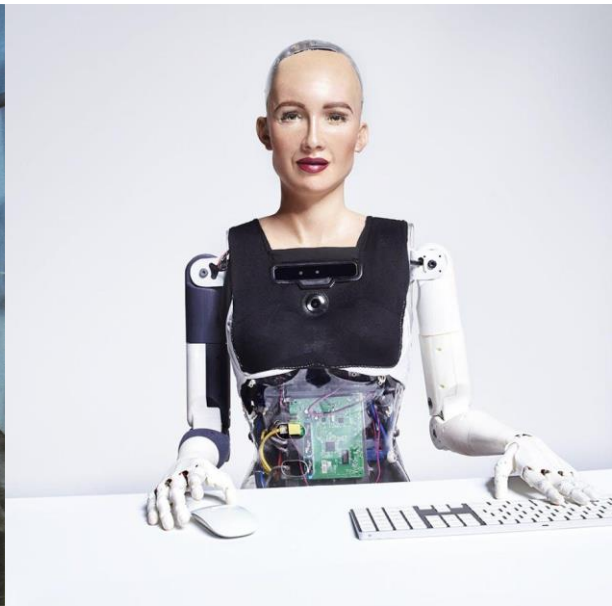
Figure 5. WABOT-1.   Figure 6. Sophia.

The Hanson robotics website contains information about Sofia, which is one of the most famous humanoid robots. This humanoid shows what can be achieved with current technology. It was first turned on February 14, 2016. Sophia can change the expressions of its face and body like a real human. It may look surprised, disgusted or it can smile. Cameras in its eyes enable it to identify faces. In addition, it can move its eyes and blink. Data processing and face recognition allow it to learn. Also, it is able to answer many questions and lead conversations on predefined topics. The software was programmed like a chatbot and can give pre-written responses. These responses create the illusion that you are speaking to a real person. The latest upgrade was that it got functional legs, and it is capable of walking (*Sophia*).

Technology which was described in the episode *Be Right Back* has no competition in the real world. Unlike Sophia, humanoid Ash's body structure is indistinguishable from the real person. Also, the skills of Ash, such as perfect motoric, all kinds of housework, or communication with other people, are unreachable with our technology. Moreover, this humanoid worked continuously during the whole episode. It was not necessary to charge it or plug it into an outlet. The question is whether humans will be ever able to create such an advanced robot, but rapid advancement in robot technology makes humanoid from *Be Right Back* much more believable. The ability to build robots and utilizing AI for grieving is very feasible. It is reasonable to believe that in the future, robots could be companions to humans. Maybe adding a slight difference, whether it is a robot or a human, might not be out of the question.

Masahiro Mori et al. (1972) were the first to find that when robots look more like humans, people consider them more acceptable than their mechanical counterparts. This fact only applies to a certain extent. When a humanoid looks almost, but not quite like a human, people feel discomfort. On the other hand, if it is like a real person, the emotional response is again positive. This phenomenon is called the uncanny valley (Mori et al., 1972). Martha had in this episode problem with her robotic boyfriend. As it was mentioned in Chapter 1.2. "Despite the similarities with her past boyfriend, she was uncomfortable and struggles to accept its existence. She becomes frustrated because of the absence of certain habits and a lack of emotions." These include, for example, Ash's sleeping with open eyes or not responding to a stuck shard in hand. So even though the technology used in this episode is more advanced than today's, it is shown that it is still not perfect.

2.1.3.1.3 Therapeutic robots

In the episode *Be Right Back*, artificial intelligence and a robotic body were used as therapeutic aid. A humanoid robot that looks like a deceased person might be a helpful tool in the future. Although robots as advanced as in this story are technologically far away, the field of medical robotics is currently very broad. Robots are used by surgeons, dentists, ophthalmologists, or to serve disabled people. The advantage of robots in medicine is that they bring higher accuracy and quality, for example, during operations. Therapeutic robots also exist in the real world. They are used as rehabilitation robots for older people or people after injury. Another usage is for social interaction and communication for people with dementia. It is not used as a chatbot like it was shown *in Be Right Back*. In the real world, scientists use patients' interactions with the robot's body and its face, as well as with the sound it emits. In the article entitled *Robo*

Therapy, Weir (2015) writes about the application of therapeutical robots in practice. Her first example is about children with an autism spectrum disorder. This child sits in a room with his mother. On the other side of the room is a human-like head. When the child backs away, the robot hangs its head and whines. When the child moves closer and looks at the robot face, it smiles and makes happy sounds. This therapy improves children's social skills. The second example is about a robot that helps with behavioural changes. This robot is called Paro, and it looks like a baby seal. It makes sound and wiggles when a patient speaks to it. Other functions are that it can respond to a name, turns toward the sound, and blinks when the light goes on. This small robot should reduce stress and stimulate social interactions. Another effect of it is that it helps reduce problematic behaviour, such as wandering and agitation. It is mostly used for patients with dementia (Weir, 2015).

2.1.3.2 Possible future of the technology

This story depicts advanced artificial intelligence. It can interact as a specific person only from reading his digital footprint. According to Brown (2021), chatbots for communication with the deceased might be a reality in future. Microsoft patented a chatbot to talk with deceased people. It should work on the same principle as software from the *Be Right Back* episode. This Microsoft's chatbot should be modelled after a specific person, and data for this project should be taken from the same sources as it was in the episode (Brown, 2021).

The story of *Be Right Back* pointed out that software that can communicate like a beloved person can have positive effects on health, but at the same time showed the need to be aware of possible addictions. After experiencing the loss of a boyfriend, the main protagonist of *Be Right Back*, who was called Martha, fell into a deep depression. The only thing that improved her mood at that moment was artificial intelligence. Martha then becomes dependent on it, even falling into a small crisis, when she drops her phone and cannot talk to the AI anymore. That clearly showed the aforementioned disadvantages of AI in this episode. Technology addiction is becoming an increasingly important issue with a growing number of new technologies. "Technology fulfils our natural human need for stimulation, interaction, and changes in the environment with great efficiency. When people experience stress, be it romantic rejection or a poor grade on an exam, technology can become a quick and easy way to fill basic needs, and as such, can become addictive" (*Technology addiction*). This quote clearly shows that the scenario from the episode *Be Right Back* in terms of possible addiction is not so far from the truth.

Chapter: 3 Social media

This chapter is devoted not only to social media from episodes *Hated in the Nation* and *Nosedive* but also to real social media. Today's social media are described at the outset. A comparison of these social media with the online ranking system from episode *Nosedive* and social media used in episode *Hated in the Nation* is made later. The privacy and security of social media is a highly debated and important topic. Their description is also part of the bachelor thesis. For each episode, the possible dangers associated with this topic will be analysed. The focus will be not only on current but also on conceivable future problems.

"Social media is a computer-based technology that facilitates the sharing of ideas, thoughts, and information through the building of virtual networks and communities. By design, social media is internet-based and gives users quick electronic communication of content. Content includes personal information, documents, videos, and photos. Users engage with social media via computer, tablet or smartphone via web-based software or web application, often utilizing it for messaging" (Dollarhide, 2020).

It is no doubt that social media platforms changed the world. People all around the globe use them. According to Chen (2021), Facebook is the largest social media with 2.8 billion active users. Chen also adds that the largest group of people who use Facebook is between 18 and 44 years old (Chen, 2021). That is probably related to the time when not only Facebook appeared, but social media in general. Social media started in the early 2000s, and that shows that it is more interesting for the younger generation and for people who grew up with it. "The first social media site to reach a million monthly active users was Myspace – it achieved this milestone around 2004. This is arguably the beginning of social media as we know it" (Ortiz-Ospina, 2019). Myspace was based on blogging, which is basically regularly updated posts on a website. In 2005 came out YouTube, and it created a new way for people to share desired files. It allowed people to share videos. In 2006 became available Twitter and already mentioned Facebook. These sites are the most famous in the world. They are based on sharing information on the wall with chosen friends. Also, they have the possibility of chatting with other people and making contacts. Instagram, launched in 2010, enabled the same things as Facebook, but the new thing was the possibility of record a story. An Instagram story is a photo or a video that is only available for one day. The last example of social media is TikTok. It is a platform used to make a variety of short-form videos. In 2020, it was the fastest growing social media (Post, 2020).

Social media uses different tactics than traditional media to make money. Traditional media are, for example, radio, print publications, and television. "For instance, the magazine publisher is a large organization that distributes expensive content to consumers, while advertisers pay for the privilege of inserting their ads into that content" (Zarella, 2009, p. 1). Websites, on the other hand, can be produced and viewed by anyone for free. Advertising is used to monetize this free access. Websites collect personal data and, on their basis, allocate advertisement. That leads to better-localized ads than those used by traditional media. Personal information is shared daily by users, and the issue is that this data might be misused. Most of this information is even publicly available. That means that with the advent of social media, the privacy of individuals has been lost.

Addiction, along with the possible misuse of information, is a serious topic related to social media. "Social media addiction is characterized as being overly concerned about social media, driven by an uncontrollable urge to log on to or use social media. In fact, psychologists estimate that as many as 5 to 10% of Americans meet the criteria for social media addiction today" (Hilliard, 2020). There is no doubt that some people, especially teenagers, spend more time there than they should. Findings indicate that stronger parental attachment is connected to less motivation to use the internet to escape from everyday problems (Soh et al., 2014). So, a possible solution to this problem may be greater parental interest. Bethune gives some real examples, why addicted people might feel worse. The first example is that when one sees pictures of happy people enjoying their lives, it can cause jealousy and sadness because this person's life does not seem so interesting. The second example is that when an addicted person sees a picture of friends at a party when this person has not been invited, this person may feel pushed away (Bethune, 2017). Media provides an environment where personal contact is unnecessary and addicted people may have trouble maintaining a personal relationship. They may experience social anxiety and have trouble talking to people or meeting new people in real life. Social media can also cause stress, although other people's lives may look more exciting on social media than they actually are.

3.1 Social media in Black Mirror

3.1.1 Hated in the Nation-Government surveillance and possible misuse of social media

Unspecified social media is used in the episode *Hated in the Nation*. It is not referred to by name, but it is very similar to Twitter or Facebook. People can share photos or tweets. Other people can let a comment below the post.

The plot of this episode is about a police investigation. During the investigation, the detectives discover that the murders were committed by ADI's. These ADI's have not malfunctioned, but they have been hacked. The hacker used the social media to target victims. This targeting is done via name, hashtag, and photo. Anyone can tweet #DeathTo with the name of the person. The hacker called this targeting people a Game of consequences. Every person who sends a hashtag takes part in this game. A person who receives the most hashtags is killed, and the game restarts the next day.

The game grew exponentially during the investigation. In the end, viewers could see that 387,000 people were involved. The game ended when detectives tracked down the hacker. He escaped, but investigators took his hard drive. Unfortunately, the hacker had left it there on purpose. When detectives attempted to disable ADI's, all ADI's attacked whoever participated in a Game of consequences. All participant of the game died as a consequence of their actions.

3.1.1.1 Comparison with existing technology

In the episode *Hated in the Nation*, viewers could see the distribution of chain posts on social media very similar to Twitter. Identical tweets from a set of duplicate bot accounts caused a rapid increase in the reach of the post. Similar problems are nowadays on real-life social media. Despite the filters, the chain posts are still spread. *Hated in the Nation* showed an extreme example of the effect this chain post can have. Even though social media appears to be an outlet for happiness, this is one of its downfalls. In this particular part of the series, users of social media shared threatening post. Ordinary people like preschool teacher shared this without knowing that it would have any consequences. And that is a crucial problem. Everybody can share almost any thought on social media. In the event of possible critical consequences, as in the case of *Black Mirror*, immediate action is needed, either from social media administrators or from the government. The most important thing is to ensure the safety of social media users. One option is to prevent access to social media, another is to turn it off.

Hated in the Nation outlines the theme of social media and government surveillance. Civil rights are stepped around here several times due to supervision. This supervision is provided by ADI's, which are equipped with secret facial recognition. The government is hiding from people that such technology exists. This episode shows that on the one side is the government that wants to have control over citizens, and on the other are common people who use social media only as a source of distraction and communication. That is parallel with real social media. "Governments are increasingly purchasing sophisticated technology to monitor their citizens' behavior on social media" (Shahbaz, 2019). Supervision over social media might be in certain situations convenient. It can lead, for example, to the detection of terrorist groups. The problem is that everyone needs to be aware of what data they are sharing. Monitoring and data collection increases the possibility of data misuse.

3.1.1.2 Social and ethical aspect of the episode

In the episode *Hated in the Nation*, were used ADI's as a murder weapon. People decided who will die using social media and the hashtag #DeathTo. The important thing is that at first people did not know it could cause death. They thought it was just a joke. The problem is that when this case went public, people did not stop using the hashtag. "Self-administered justice has happened throughout human history. It is often called "trial by mob." And because of the unpredictability of mobs, most societies have established systems to prevent it" (Maya, 2020, p. 129). *Hated in the Nation* showed that "trial by mob" is possible on social media. The crowd decided who would die independently of the courts and without the ability for accused persons to defend themselves. The question is whether this is fair. Can these people make credible decisions about such an important thing as killing a person? In this episode, rapper Trusk was killed by ADI because he offended the dancing skills of a young boy. In my opinion, this act is not so serious that someone should die because of it. The issue is that Trusk insulted the boy in public, which made him unpopular in society. And the killing in this episode was just a matter of popularity. An important problem with the mob is that it can be easily manipulated. Maya (2020) states that "mob can be easily misdirected by individuals with a hidden agenda – like competitors, activists, and ex-partners – by misinformation, emotional appeals, false news stories, faulty evidence, and bad arguments" (Maya, 2020, p. 130). That is a reason why lawsuits exist. Everyone is judged fairly by the court, and everyone can be defended. In the case of "trial by the mob" this is not possible, and the actions of the mob can have serious consequences.

3.1.2 Nosedive-Social ranking system and social media addiction

Nosedive shows the world in which are people fully dependent on social media. Everyone in this episode can rate other people on the social media on a scale from one star to five stars. This rating influences many aspects of life. It affects the job assignment, place of residence or even determines the choice of friends. Anyone with a good rating can have great life benefits. The basic values are completely different here than in reality. For higher connectivity with social media, people are equipped with retinal implants. These implants are connected to the phone, and everyone with them immediately sees other people's ratings.

Lacie Pound, which is the main character of this story, is a person who strives for the best possible rating. She is unsatisfied with her life. Her dream is to live in a lifestyle community with her dream husband and simulated life. Clearly, she wants to live in a world full of hypocrisy. She smiles at all people without ceasing, even if they irritate her. Also, a photo of a coffee is more important than the taste of the coffee for her. During this episode, Lacie meets many different personalities who try to get the best possible rating. Their efforts to get her best possible rating at all costs seems perfectly normal to her. The problem for her occurs when she gets into trouble. With low ranking, nobody wants to help her. The only person who is willing to help is a person with a rating 1,4 stars. Lacie does not want her help at first because she thinks that this must be a bad person. After a while, Lacie realizes that she is a kind character who says what she wants. That is not completely normal in this society, and that is the reason for the terrible ranking.

At the end of this episode, viewers can see that Lacie is imprisoned. Her retinal implants were removed, so there is no threat of being punished. That is the first time in this episode when lacy seems free. She curses at her fellow prisoner and enjoys it.

3.1.2.1 Comparison with existing technology

Social Credit System, which works in China, score individuals based on collected data from different sources. "One city, Rongcheng, gives all residents 1,000 points to start. Authorities make deductions for bad behaviour and add points for good behaviour" (Kobie, 2019). Points can be lost very easily. If anyone spread negative news about the government over the Internet, it means deduction. If a citizen has more than two children, it means deduction. The withdrawal of points can also be by for non-payment of tax or traffic violation. Points might be added for good actions such as donating to charity, helping police with the investigation, sending kids to the army or donating organs. Lee (2020) states that the punishing element is more developed

than the reward element. This rating can have serious consequences for local people. "Individuals who are deemed untrustworthy could face a number of restrictions affecting areas including loans, travelling by air and rail as well as education" (Lee, 2020). That is not happening only in Rongcheng but throughout China. Much data is collected about most Chinese citizens. The government monitors medical records, online purchases, media activities or tax payments. Besides, they are monitored by the installation of CCTV cameras with facial recognition and plate recognition (Creemers, 2018).

Social Credit System and the *Nosedive* ranking system have many similarities and can therefore be compared. Both systems control people in a certain way. Both systems influence everyday life and can have an impact, for example, on work. The main difference is that in the *Nosedive* system, people rate each other, while in China, it is a government function. That is a crucial point. In *Nosedive*, people behave well to make people like them. That then determines the fines or benefits. In China, it is controlled by the government. The actions of the government can then determine the future of a particular citizen. The question is whether, in *Nosedive*, it is the work of the government or the people themselves. Viewers cannot see in this episode the person who is behind this social media. It could have evolved from a classic social media that exists today. It is not such an unimaginable scenario. The social media from this episode is very similar to Facebook. The common knowledge is that people are already dependent on ratings on Facebook. The only luck is that it is not that spread and that radical. Another possible scenario is that the government is behind it. In that case, the controlling of people would be way more similar to the Chinese system.

The consequence of the *Nosedive* ranking system is that most people live in an artificially created reality, where stars are the most important thing. For all people is crucial to be aware of possible addiction to rating so that it does not turn out like in the *Black Mirror*.

3.1.2.2 Social and ethical aspect of the episode

Nosedive helps understand the possible dangers of social media. It basically gives the message that no one should take social media too seriously. Social media were created as a communication source and a fun tool. The problem is that it entices people to use it too often. An example from this episode is a truck driver whose resistance toward technology makes her the only polite character from the whole episode. Her agility against the rating system is her strength. This episode proves that the social media account does not always represent who the person really is. The obsession with social status and the disguising of identity is in *Nosedive* omnipresent. For people in this artificially created society, a photo of a cookie is more important than its taste. Lacie showed it beautifully in one scene where she bit into a cookie and then spat it out. The only thing that mattered at that moment was the photo and the rating on social media. To get the best possible rating, she even practices laughing in front of a mirror. And every time she gets a five-star rating, her eyes light up, she smiles and giggles with excited joy. But at the end of the day, Lacie seems lonely and unsatisfied. Her real friends are not on the screen in this episode, not even for a moment. The only thing that can be seen are insincere smiles from strangers. That shows that social media does not guarantee long-term happiness. If someone is too committed to rating on social media in the future, this person will probably end up like Lacie at the end of the episode.

Nosedive shows social media that is based on popularity. Unpopular people with low ranking have problems at work or, for example, when looking for an apartment. The issue with this ranking system is that it seems especially susceptible to abuse of selected victims. In this episode, the whole office ganged up on a person, causing his rating to drop below 2.5. They did it only because he broke up with his boyfriend, who is a popular person. The consequence of these actions was that the security guards did not let him into the building where he works. That is principally a demonstration of the "trial by mob" phenomenon. It is not as serious as deciding who will die with #DeathTo from episode *Hated in the Nation*, but the general idea is the same. Based on popularity, the crowd decides on the future of specific people. That is one of the reasons why individual ranking may not correspond to the moral values of persons. A great example is a truck driver with a one-star rating, even though she was a good person.

This part of the series also reminded that people like to have the same opinion as the crowd. That is a serious topic in the real world. People make decisions about politics on social media. They believe everything about political parties, regardless of evidence or another opinion. In this situation, arguments and facts do not matter because people make decisions based on populist gestures. People have always done this to some extent, but social media has deepened it.

Conclusion

The aim of the bachelor thesis was to analyze the feasibility of selected technologies depicted in the *Black Mirror* series. Two main topics that were described in the bachelor thesis were robots and social media. Five episodes were selected, and their plot and the technology used in them were described. The social and ethical issues associated with these technologies were also outlined.

In this bachelor thesis, robots from the episodes *Metalhead*, *Be Right Back* and *Hated in the Nation* were described. It turned out that insect-scale robots from the episode *Hated in the Nation* cannot be created in the real world today. Robobees outlines that it is possible to achieve a certain level of development, but there are still too many challenges, such as power supply, to overcome. The robotic dog from the episode *Metalhead* is also superior to modern technologies. Its movement and appearance resemble Spot, which is a modern quadruped robot. Indisputable advantages of the *Metalhead's* dog are power, speed, and artificial intelligence. These aspects of the robot are out of reach for today's scientists. The artificial intelligence of humanoid from the episode *Be Right Back* is even more sophisticated than the *Metalhead's* dogs one. It is able to communicate with other people, perfectly perceive the surroundings and respond to various complicated situations. In terms of humanoid as a robot, it is also way more advanced than what can scientist create today. It looks exactly like a human being, and it is capable of doing ordinary things like a real person, such as housework. Nowadays, humanoids can do interesting things. They are able to walk, communicate on a certain level with people, or mimic the movements of a human face. It is an example of what scientists can do with current technologies, but it is not even close to humanoid Ash from the episode *Be Right Back*.

Social media from the episodes *Hated in the Nation* and *Nosedive* are also depicted in the bachelor thesis. The social media used in the episode *Hated in the Nation* are very similar to those used today. Their functions are basically the same. Anyone can share posts, and other users can comment or forward them. The *Nosedive* scenario is a bit different. Social media is bread and butter for everyone in this reality, and it is based on the ranking of their users. That can lead to many problems, such as addiction or virtual abuse of selected victims. Also, in both episodes arises the danger of possible civil surveillance through social media. Watching these episodes can help people understand the potential dangers of social media and what everyone should avoid. Anyone who takes social media too seriously should watch these episodes to be aware of what can happen.

To sum up everything that has been stated so far, robots from chosen episodes are way more advanced than the latest robots. Current technology is insufficient to create such machines, but in the future it is theoretically possible. There are still issues like an uncanny valley or future ethical questions which need to be solved first. It is possible that technological development will help with these problems. One of the possible solutions from the ethical point of view of robots might be adopting a resolution on legal and ethical rules in robotics. Here it is possible to take an example from Asimov's rules of robotics. In terms of Social media, people need to be aware of possible misuse and addiction. It is very likely that social media will continue to be used in the future. Their advantages, such as fast communication, obtaining information or contact with friends, are unquestionable. It is still necessary not to be fully committed to social media and monitor the time spent on them, because if humans ever try to create an artificial society based on social media, it will probably end up like in *Nosedive*.

Rozšířený abstrakt

Black Mirror je britský dystopický sci-fi seriál vytvořený Charliem Brookerem. Tento seriál byl původně vysílán na britském kanálu Channel 4 a odbyl si svoji premiéru v prosinci roku 2011. V roce 2015 byl tento seriál odkoupen streamovací společností Netflix. *Black Mirror* zkoumá dopad technologií a moderních vynálezů na společnost. Většinou ukazuje dystopickou vizi budoucnosti. Díky vyobrazeným alternativním realitám mohou diváci přemýšlet o důsledcích, které technologický rozvoj přináší. Sledování *Black Mirroru* je vzrušující a nutí diváky přemýšlet o jednotlivých technologiích. Je pokrok v oblasti technologie dobrý nebo špatný? Může být nebezpečný nebo pouze užitečný? Všechny tyto otázky vyvstávají při sledování této show.

Tato bakalářská práce se zaměřuje na negativní i pozitivní aspekty technologie vyobrazených ve vybraných epizodách seriálu *Black Mirror*. Konkrétně se orientuje na roboty a sociální média a nastiňuje, jak je tvůrci ukázali v tomto seriálu. Důležitou součástí práce je snaha odpovědět, zda je možné dosáhnout podobné technologie v reálném světě. Zároveň se tato práce snaží zaměřit na sociální a etické problémy spojenou s danými technologiemi. Práce je strukturovaná do tří hlavních kapitol. V první kapitole je popsán děj čtyř vybraných dílů. Mezi tyto díly patří *Metalhead*, *Be Right Back*, *Hated in the Nation* a *Nosedive*. Tyto epizody jsou na sobě nezávislé a jsou zasazeny do různých alternativních budoucností a byly vybrány, protože dobře ukazují použité technologie. Druhá kapitola je zaměřena roboty použité ve vybraných dílech. Nejprve je zde prezentován létající robot v měřítku hmyzu z epizody *Hated in the Nation*, který je posléze porovnán s RoboBee. Následně tato kapitola porovnává čtyřnohého robota podobného psovi z epizody *Metalhead* s jeho ekvivalentem z reálného světa zvaným Spot. A nakonec je zde představen humanoidní robot Ash a jeho umělá inteligence z epizody *Be Right Back*. Ash je srovnáván se Sofií, humanoidním robotem vyvinutým společností Hanson Robotics. Třetí kapitola se soustředí na sociální sítě vyobrazené v epizodách *Hated in the Nation* a *Nosedive*. Tyto sociální sítě jsou porovnány se skutečnými sociálními sítěmi. Konkrétně se toto srovnání zaměřuje na možné problémy s nimi spojené, například závislost. Současně je důležitou součástí srovnání také sociální a etický aspekt sociálních sítí.

Tato práce odhalila, že roboty v měřítku hmyzu z epizody *Hated in the Nation*, které se nazývají ADI, nelze ve skutečném světě vytvořit. Roboti ADI byly porovnáni s RoboBee, nejmodernějším ekvivalentem, který byl vytvořen týmem z Harvardské univerzity. Mezi výhody ADI patří lepší baterie, schopnost sebereprodukce, schopnost rozpoznávání obličeje,

nebo i skutečnost, že jsou autonomní. Pro dosažení této technologie ze seriálu *Black Mirror* bude zapotřebí například vylepšit technologii baterií. Dále byl porovnán čtyřnohý robot podobný psovi z epizody *Metalhead* se Spotem, který má velice podobný design. Rozdíly mezi Spotem a robotickým psem z epizody *Metalhead* jsou v jejich vybavení a schopnostech. Tento robotický pes má oproti Spotovi lepší umělou inteligenci, je solárně napájen, má lepší baterii, je rychlejší, má dokonalejší senzory a v nohách má zabudované zbraně. V případě, že v budoucnu budou vědci chtít dát zbraně umělé inteligenci, bude zapotřebí jim do paměti zakódovat základy roboetiky, aby nemohli obrátit zbraně proti nevinným lidem. Humanoid Ash z epizody *Be Right Back* byl porovnán se Sofií, humanoidním robotem vyvinutým společností Hanson Robotics a jeho umělá inteligence s chatbotem Mitsuku. Ukázalo se, že humanoid Ash je nadřazený jak Sofii, tak Mitsukovi. Ashova umělá inteligence, narozdíl od té Mitsukovi, dokáže komunikovat za každé situace. Dalším rozdílem mezi nimi je fakt, že humanoid Ash je terapeutický nástroj, mezitím co Mitsuku pouze chatuje s lidmi na internetu. Největším technologickým pokrokem v této epizodě oproti skutečnému světu je spojení této pokročilé umělé inteligence s humanoidním robotem. Humanoid Ash má perfektní motoriku, zvládá jakékoliv domácí práce a je k nerozeznání od reálné osoby. Těmto konkrétním technologiím dnes vědci nedokáží konkurovat.

Sociální síť vyobrazená v epizodě *Hated in the Nation* je svými funkcemi a vizuálem velice podobná Twitteru nebo Facebooku. Jakýkoliv uživatel této sítě může sdílet příspěvky a ostatní uživatelé je mohou komentovat, nebo přeposílat. V tomto konkrétním díle byly identické tweety s výhružnou zprávou šířeny nejprve spamboty a následně i ostatními uživateli této sociální sítě. Uživatelé, kteří sdíleli tuto zprávu, zemřeli na konci dílu jako následek svých činů. S podobnými problémy se dá setkat i na skutečných sociálních sítích. Navzdory různým filtrům jsou řetězové zprávy každodenně sdíleny. Přestože *Hated in the Nation* ukázal extrémní dopad, který takový příspěvek může mít, tak by všichni na sociálních sítích měli být velice opatrní. Analýza této epizody ukázala, že by si lidé měli více chránit své soukromí na internetu a měli by si dávat pozor na to, jaká data sdílí. Sociální síť používaná v díle *Nosedive* je založená na hodnocení ostatních uživatelů a používá ji zde úplně každý. Fakt, že je tato sociální síť založená na hodnocení zde vede k mnoha problémům, jako například závislost, nebo virtuální týrání vybraných obětí. Tato sociální síť byla porovnána se systémem sociálního kreditu, což je státní systém hodnocení obyvatel Čínské lidové republiky. Hlavním rozdílem mezi těmito hodnotícími systémy je ten, že v *Nosedive* záleží na hodnocení ostatních lidí, kdežto u systému sociálního kreditu je hodnocení vládní funkce. Největším problémem v této epizodě byla ztráta

možnosti se vyjadřovat a chovat se přirozeně, kvůli obavě o následné obdržení nízkého hodnocení. Po analýze sociálních sítí z epizod *Hated in the Nation* a *Nosedive* je jasné že je potřeba si dávat pozor na možnou budoucí kontrolu obyvatel skrze sociální sítě.

Na základě porovnání robotů z vybraných epizod seriálu *Black Mirror* s jejich skutečnými ekvivalenty vyplývá, že jsou jim nadřízeni. Současná technologie k vytvoření takových strojů nestačí, ale v budoucnu je to teoreticky možné. Stále je však třeba nejprve vyřešit budoucí etickou stránku robotů. Je možné že s tímto pomůže technologický vývoj. Jedním z možných řešení je usnesení o etických pravidlech v robotice. Zde je možné si vzít příklad z Asimových pravidel robotiky. Pokud jde o sociální sítě, je zřejmé, že mají nesporné výhody, jako je rychlá komunikace, získávání informací nebo kontakt s přáteli. Z těchto důvodů budou s největší pravděpodobností i nadále velice oblíbené. Z této práce je však patrné že je třeba si dávat pozor na možné zneužití dat a závislost na těchto sociálních sítích. Je nutné se plně neoddávat sociálním sítím a sledovat čas na nich strávený, protože pokud by se společnost někdy rozhodla věnovat jim příliš mnoho času, mohlo by to skončit jako v *Nosedive*.

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