

### STEP 1. Identify Challenges

Read the Future Scene carefully and generate ideas for challenges, concerns, and possible related problems. Choose the 16 most important challenges and write them in the space provided

<p>Education</p> <p>Since the DBS device overrides Oliver's limbic system when it predicts an outburst may occur, it may be possible that Oliver is solely dependent on the DBS device to control his outbursts. This is a problem because it may mean that children like Oliver who have cognitive issues</p> <p>1 have not been able to learn how to regulate their own emotions/impulses on their own, this means that the root of their psychological issues are not solved and may continue or even worsen should the DBS device cease to function. This would also imply that these children do not have a holistic education in the sense that they have not learnt how to regulate their own emotions.</p>
<p>Ethics</p> <p>Since the military-mandated implant officers receive reduce stress responses by adjusting their autonomic nervous systems and hormones, it may be possible that in times of war the military commander may choose to drastically reduce the stress or fear of the soldiers. This is a problem because such an action may increase the mortality rate of the soldiers as they are unable to accurately sense the level of danger they are in.</p> <p>2</p>
<p>Law and order</p> <p>Since DBS implants have the ability to override the limbic system, which are the structures responsible for behavioural and emotional responses, it may be possible that individuals with the DBS implant do not have full control over their actions and the level of control they have may be indeterminable. This is a problem because should such individuals commit a crime, it may be difficult to arrive at a fair sentence for them given that the judge cannot determine how much control and thus responsibility the individual has over their actions.</p> <p>3</p>
<p>Physical health</p> <p>Since Nikola has occasionally received controlled bursts of adrenaline to produce eustres for periods of tough and intense work through her implant, it may be possible that commanders</p> <p>4 are unable to get an accurate account of the level of physical exhaustion of the soldiers. This is a problems as this may result in the commanders sending bursts of adrenaline to the soldiers to get them to work even though their body has gone beyond an acceptable level of exhaustion, which may result in damage to their physical health</p>
<p>Psychological Health</p> <p>Since Nikola's stress levels have risen as she looks for work and reintegrates back into civilian society, it may be possible that she has developed some sort of reliance on the military-mandated implant that officers receive before their service that reduces stress responses. This could be a problem as since Nikola has become accustomed to relying on the implant to deal with stress, she is unable to deal with her stressors effectively on her own after years in the military service.</p> <p>5</p>
<p>Social Relationships</p> <p>Although Oliver has become calmer after his DBS device implant, his sleep schedule has become erratic and he has lost interest in sports. This suggests that the DBS implant could have potentially altered his original personality and also affected his sleeping</p> <p>6 ability since the DBS device sends electrical impulses to override his limbic system. This may be a problem as his change in personality and lack of sleep could lead to changes within his social dynamics and this could strain his relationships with his close ones who knew him before his implant.</p>

7 Defense Since the E-Sports Outfitters where Ricardo works already surveils him at all times, tracking his smart devices to calculate everything from when he should arrive for his shifts to his productivity and general physical health, it may be possible that other companies have also produced smart devices with similar tracking and deep learning capabilities. This may be a problem as malicious groups may misuse such devices and harm innocent parties to their own advantage through intense surveillance and manipulation granted by such devices.

8 Technology When Nikola retired, her military-mandated implant had been deactivated and the doctors assured her that the implant should no longer interfere with her natural emotional response. However, her stress levels had risen and had even stepped into a busy crosswalk without even thinking about the cars whizzing toward her, thus it may be possible that her emotional response had been affected without the doctor's notice. This may be a problem as the side effects of this new technology may not be fully understood by doctors and its unknown side effects may have significant negative impacts on the people's health.

#### Business and Commerce

9 Since patients undergoing comprehensive neurotechnology therapies like Oliver have a tendency to have emotional outbursts where they have a lack of self control and Nikola who experienced frequent headaches, it may be possible that when looking for a job, employers will be afraid that these will affect their job productivity and other employees, and cause patients to seem less valuable to the company. This may be a problem because it would affect their employability and it could be hard for patients to find jobs to support themselves and their families.

#### Ethics and Religion

10 Since Prisha's treatment team is discussing to assign her to an Enhanced Emotional Support Animal Assistant (EESAA) which is an animal genetically designed through a modified cloning process and neurologically altered, it may be possible that it could be seen as unethical for animals to have their bodies and senses enhanced artificially for the benefit and service of humans. This may be a problem as it would not only violate animal rights but also infringe on that of human activists who believe strongly in and campaign for such rights.

#### Recreation

11 Since Ricardo's smart devices are constantly tracking when he should arrive for his shifts to his productivity, it may be possible that he feels pressured to and held accountable by these devices to achieve higher rates of productivity at work and spend more time at work to do so. This may be a problem as he would likely have less free time that he could spend on recreational activities and his hobbies.

#### Technology

12 Since implants like the deep brain stimulation (DBS) device and the military-mandated implant officers receive before their service are required to constantly send electronic signals to and from the patient, it may be possible that the device, small enough to be implanted in the brain, is functioning at a high level and requires high processing power. This may be a problem as the tiny device may overheat and cause harm to the brain tissue that it is surrounded by, especially since it may be deeply enmeshed in the brain tissue.

13 (Physical Health) Since the brain implants have resulted in negative health impacts such as worsening Oliver's insomnia and the frequent headaches in Nikola even after the implants have been deactivated, it may be possible that prolonged usage of these devices would lead to further, more serious health issues that may be fatal or extremely debilitating. Furthermore, such devices that are directly implanted into the brain may be impossible to remove without huge risks. This may be a problem as the physical condition of the people using these devices would be negatively affected instead without a viable way of stopping it

(Ethics and Religion) Since the DBS implanted in Oliver has caused him to lose his interest in sports and instead desire to join his school's drama club, it may be possible that these devices  
14 can unknowingly alter a person's personality and behaviour. This may be a problem as it would infringe on the right to freedom and choice of the person and prevent them from exercising free will, and prevent them from establishing their own self-identity.

(Basic Needs) Since the EESAAs come with a steep prices and the US Affordable Healthcare System only covers 40% of the cost while another 40% is covered by a private insurance plan that Prisha has, it may be possible that poorer people who cannot afford to keep up an  
15 insurance plan would have to pay 60% of the cost, which is a significant amount that they are likely unable to afford. Furthermore, even if they did manage to have a private insurance plan, it is possible that the 20% left is still too expensive for them to cover out of their own pockets. This may be a problem as some who desperately need these animal assistants to aid in their daily lives may be deprived of them due to the high cost that they are unable to pay.

(Ethics and Religion) Since BCIs are being regarded as the "waves of the future" and less invasive technologies such as EEG headbands to control prosthetics are being outdated and the technologies needed to support them are becoming obsolete and removed from institutes, it  
16 may be possible that patients in the future would not have a choice between an invasive option and a non-invasive option and would be forced to take the invasive BCI or not receive the help they need at all. This may be a problem as it infringes on the freedom of choice of these patients and having an invasive implant may violate their bodily autonomy.

## STEP 2. Identify the Underlying Problem

Using the challenges listed in Step 1, identify a problem of major importance to the Future Scene situation. Write your Underlying Problem making sure your question clearly explains the action that will be taken and the desired results/goal of that action.

Since the brain implants have resulted in negative health impacts such as worsening Oliver's insomnia and the frequent headaches in Nikola even after the implants have been deactivated, how might we improve the safety of the Neurotechnology used by the CIN so that there can be the successful continuation of Neurotechnology therapies at the CIN in the USA in year 2045 and beyond.

## STEP 3. Develop Solutions

Generate solution ideas to the Underlying Problem in Step 2. Choose the 16 most effective solutions and write the elaborated ideas in the space provided.

(Government and Politics) Neurotechnology's Board of Directors can work with international health groups such as the World Health Organisation and BRAIN to create international laws (eg. Neurorights) to protect individual's rights to mental privacy and individual identity. Such  
1 laws can include those that mandate privacy and consent before implantation of invasive technologies, so that users like Ricardo will not be doubtful and fear that the BCI will interfere with his personal privacy or have intrusive access to his BCI data. This will allow the continued safe usage of Neutrotechnologies as users are better able to safeguard themselves against intrusive technologies without their consent.

2 (Physical Health) The Board of Directors of the Cascadia Institute for Neurotechnology can work with the government and health experts in Neurotechnology to create an independent working group of experts who can give independent reviews and appraisals of the potential harms of each different type of Neurotechnology therapy that has been created by CIN and also evaluate the probably efficacy of these therapies. Approval by this independent working group would have to be conducted before the CIN is authorized to allow use of the therapy by patients. By creating a more vigorous system to ensure that the therapies are safe and will not cause any serious negative health impacts, the CIN will be able to improve the safety of the Neurotechnology in the CIN so that there can be the successful continuation of these Neurotechnology therapies.

3 (Technology) Bio Engineers and neuroscientists from CIN can work together to create a device that is made up of many miniscule components. These components can be created in the form of nanobots that can be controlled via a highly precise AI program that provides a real-time digital model of the person and the locations of the nanobots. These nanobots can be injected into a person's bloodstream when needed and travel to the person's brain via their blood. Once in the brain, these nanobots move through the blood-brain barrier and into the region of the brain where they are required, and self-assemble into the full device. The device can also be easily disassembled when issues such as unforeseen health problems arise or when it is no longer required into the form of nanobots which can then be removed from the body through natural bodily processes. This would allow any issues with the device to immediately be addressed and mitigated, and also make the implanting of the device less invasive and risky, hence improving the safety of Neurotechnology so that there can be the successful continuation of Neurotechnology therapies at the CIN in the USA in the year 2045 and beyond.

4 (Technology) Neurotechnology's Board of Directors can work with neuroscience doctors, engineers, and computer scientists to build a brain simulator that is able to accurately replicate any person's brain. Through AI and deep learning techniques, this VR brain simulator will be able to replicate how the person's brain may respond to new implantations and the removal/deactivation of previous implantations. This is so that doctors at the CIN will be better able to guide and advise patients on whether to go through with a certain type of implantation or use a different type of Neurotechnology safer for the patient's use instead, since different brains have variable responses to the same Neurotechnology.

5 (Communication)The CIN can work together with engineers and scientists to create a microsensor which is embedded in flesh-like gel that can be inserted under the skin of the patients receiving Neurotechnology therapy by the CIN, in such a way that it is minimally invasive. This microsensor can be lined with receptors that are constantly testing blood flow for unusual hormone levels and able to detect abnormal nervous system behaviour. This is then wirelessly connected to the phone of these patients, which will receive constant electrical signals emitted from these microsensors and are then able to monitor their health and ensure that there are no malfunctions. If there are abnormalities in the performance of the Neurotechnology implants, the microsensor will alert the CIN immediately, who will then be able to provide proper medical help to the patients. Thus, this will allow patients to more safely use such Neurotechnology to ensure their successful continuation.

6 (Psychological Health) Neurotechnology's Board of Directors can work with medical engineers and neuroscience doctors to develop an fMRI and fNIRS machine with AI capabilities that are able to analyse large amounts of data gained from brain monitoring devices used by current patients. Through deep learning and machine learning, these sophisticated machines are able to deduce the specific treatments that patients should have to alleviate the negative impacts that the implants may have on the mental and emotional health. Since patients like Oliver suffer from an erratic sleep schedule and Nikola also is mentally affected by the deactivation of her implant, this machine will be able to allow doctors to give targeted treatment to the variable responses that patients may have to a certain implant.

(Ethics and Religion) Engineers and neuroscientists at the CIN can work together with their respective patients and involve them in the process of the creation of their device. This would make the process more transparent to their patient and allow them to have a greater understanding of the device that will be implanted into them. The patient may also discuss and negotiate with the engineers to decide on the exact functionality to be given to their device in order to create a device that they are satisfied with and is tailored to them, for example,

7 reducing number of things that the device can do as a trade off for coding in more programmes for privacy protection. This would allow the patient to have greater control over their device and the level of data safety afforded to them. Moreover, the greater transparency in the creation process may also result in more care given in creating the device and better programming used for data protection due to increased scrutiny by the people. Hence, this may improve the safety of Neurotechnology so that there can be the successful continuation of Neurotechnology therapies at the CIN in the USA in the year 2045 and beyond.

(Communication) CIN can work with the military to come up with a communication system between the implants, the commander's computers. The implants can detect the levels of physical exhaustion of the military officers by detecting the levels of lactic acid in their body.

8 The implant will then communicate this data to the commanders so the commanders know how much adrenaline they can give to the officers without risking damage to their physical health. This ensures that the military officers can continue to use the implants for their training but will not suffer extensive damage to their physical health because of it, thus improving the safety of the Neurotechnology so that

(Defense) The government and AI specialists can work together with neuroscientists and bioengineers at the CIN to create an AI that monitors the activity of each device. In the event that there is a security threat to the person using the device, such as interference/hacking by a malicious third party, or malfunctioning of the device, the AI may then choose the best method and address such issues in real-time, and immediately when they arise. For instance, for hackers that use an easily identified method, the AI may try to defend against it in real time by blocking the hacker and removing any foreign programming or data they may have left. The AI

9 will then alert the scientists at CIN of this. For instances where a previously prescribed method may not be available, the AI may then directly alert the scientists of this such that they can devise a novel solution to it. This would make addressing issues in the device faster. Constant monitoring of each individual device would also allow any issues to be more clearly seen, rather than only being able to rely on the outward behaviour of the person or any health issues they might have to know that there is a problem with their implant. Hence, this may improve the safety of Neurotechnology so that there can be the successful continuation of Neurotechnology therapies at the CIN in the USA in the year 2045 and beyond.

(Education) CIN can come up with an AI system that will create specialised courses for each individual, according to the neurotechnology that they use, and the organisations that have access to their neurotech data. The courses will educate the individual on the health risks of their neurotechnology and the level of access each organisation has to their data. This will increase the transparency between the users of the neurotech, neurotechnology companies and

10 the organisations that use the data and ensure that the users are better educated about their own neurotechnology implants. This allows for better accountability for both the neurotechnology companies and the organisations that use the data, which will encourage them to increase the levels of safety in terms of the security of the users data. This will allow the users to have better trust in the neurotechnology therapies, so that there can be the successful continuation of Neurotechnology therapies

(Law and Order) Government officials can work with neurotechnology experts and AI specialists to come up with an AI system that will gather feedback on the problems faced by users of Neurotechnology therapies in terms of safety and analyze this data to find the underlying problems faced. The AI system will then refer to current laws in the judiciary system to come up with potential laws that can be passed to mitigate the problems faced by the users. This can be in terms of ensuring fair access to neurotechnologies or transparency of data. Government officials will then evaluate all the possible laws and refine them so as to come up with a set of laws that will ensure of the safety of users using neurotechnology therapies so that there can be the successful continuation of Neurotechnology therapies

(Defence) Government officials can work with AI specialists and neurotechnology specialists to come up with an AI system that can detect possible faults and gaps in the neurotechnology therapy security firewalls prior to its implementation. Using this data, the neurotechnology specialists will then work to strengthen the firewall, increasing the security of it. This will ensure that third-parties cannot gain access to the neurotechnology devices implanted in the military personnel and/or civilians, which reduces the vulnerability of users to attacks/control by third-party organisations. This will increase the safety of neurotechnology therapies so that they can continue to be used successfully.

(Education)The CIN can work together with engineers and past patients of neurotechnology therapy at the CIN to come up with a electrode stimulated simulation that is compulsory for all potential patients of neurotechnology therapy to go through before receiving the therapy. With the aid of non-invasive electrodes to stimulate the brain to make the experience even more realistic and VR simulation technology, potential patients will be brought through an immersive experience that allows them to experience what it is like to receive neurotechnology therapy. In addition to learning more about the processes that are involved, the patients can also familiarise themselves with tips from past patients on how they may be able to more safely navigate use of this technology, e.g. refraining from certain exercises that may be damaging for the brain implant, etc. through superimposed text that appear on the VR simulated interface. Since this may be expensive, the CIN can engage venture capitalists who may be willing to subsidise the cost of the research and development involved. Hence, this will allow patients to use Neurotechnology more safely and allow for the successful continuation of such therapies.

(Education) Neurotechnology's Board of Directors can work with medical institutes and reputable Neurotechnology organisations to increase the protections for people's right to be educated about the possible cognitive and emotional effects of Neurotechnology. This can be done so by teaching doctors, nurses, and medical assistants about patient confidentiality when using Neurotechnology, so that they will be better able to inform the patients' of their rights and the impacts that the Neurotechnology may have. Especially since doctors are required to take the Hippocratic oath, they may also add a clause for their duty of justice in the use of Neurotechnology. These actions will better protect the patients' safety before using the technology.

(Social Relationships)CIN can organise events where past and current patients who have used or are currently using similar neurotechnology therapies implants can come together to share their experiences about using the neurotechnology therapies and also some possible side effects that may have happened to them, such that new patients can be more aware of the health risks that may come with the use of the neurotechnologies therapies and even how to resolve certain problems that may arise. Medical professionals at these events can also give informed advice to these patients that would allow them to keep track of their health and minimise their health risks. By forming bonds in the community, users of neurotechnology therapies could also hopefully create systems where they can look after one another in the long run and monitor each other's health, therefore preventing them from having extensive long term harm to their physical health and increasing the safety of the neurotechnology therapies so that they can continue to be used successfully.

16 (Business and Commerce) The government can push more funding into the neurotechnology sector in the form of grants for research or for promising start-ups in the sector. This may push more people to join the sector, and thus result in greater ideas and innovation. A more competitive market would also push companies to innovate in order to differentiate themselves from competitors, hence resulting in a greater diversity of products that may address different people's needs more accurately. Such competition would also push companies to constantly improve on their products in order to attract new consumers, hence making them more safe as companies would need to reduce the negative health impacts and increase the data protection of their devices or else they risk being called out/compared to other companies and being outcompeted by them. A more vibrant, competitive and diverse neurotechnology market may hence allow for people to get the most suitable device for them and also push for constant, sustained improvements in the technology. Hence, this may improve the safety of Neurotechnology so that there can be the successful continuation of Neurotechnology therapies at the CIN in the USA in the year 2045 and beyond.

**STEP 4. Generate Criteria**

Generate criteria to determine which solution idea does the best job of solving the Underlying Problem and/or addressing the Future Scene situation. Select the 5 most important criteria for measuring solution ideas and write them in the spaces provided.

1	Which solution will best ensure that there can be the successful continuation of Neurotechnology therapies?
2	Which solution will best improve the safety of the Neurotechnology used by the CIN?
3	Since the side effects of Neurotechnologies are not well understood and the implications related to its use have not been fully explored, WSW best minimise the unforeseen impacts that the Neurotechnologies may have on patients?
4	Since neurotechnologies such as EESAA come with a steep price, which is only 40% covered by the US Affordable Healthcare system, which solution will require the least amount of cost to implement?
5	WSW would best increase the transparency of the functionalities of Neurotechnology between the users and the CIN?

**STEP 5. Apply Criteria to Solutions**

From the solution ideas written in Step 3, select the 8 ideas with the most potential to solve the Underlying Problem and list them on the grid. Use each criterion to rank the solutions on a scale from 1 (poorest) to 8 (best). The numerical ranking for one important criterion may be doubled.

Rank solutions.

#	Solution	1	2	3	4	5	Criteria Total
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1	<p>(Defense) The government and AI specialists can work together with neuroscientists and bioengineers at the CIN to create an AI that monitors the activity of each device. In the event that there is a security threat to the person using the device, such as interference/hacking by a malicious third party, or malfunctioning of the device, the AI may then choose the best method and address such issues in real-time, and immediately when they arise. For instance, for hackers that use an easily identified method, the AI may try to defend against it in real time by blocking the hacker and removing any foreign programming or data they may have left. The AI will then alert the scientists at CIN of this. For instances where a previously prescribed method may not be available, the AI may then directly alert the scientists of this such that they can devise a novel solution to it. This would make addressing issues in the device faster. Constant monitoring of each individual device would also allow any issues to be more clearly seen, rather than only being able to rely on the outward behaviour of the person or any health issues they might have to know that there is a problem with their implant. Hence, this may improve the safety of Neurotechnology so that there can be the successful continuation of Neurotechnology therapies at the CIN in the USA in the year 2045 and beyond.</p>	7 8 6 2 4	27
2	<p>(Education)The CIN can work together with engineers and past patients of neurotechnology therapy at the CIN to come up with a electrode stimulated simulation that is compulsory for all potential patients of neurotechnology therapy to go through before receiving the therapy. With the aid of non-invasive electrodes to stimulate the brain to make the experience even more realistic and VR simulation technology, potential patients will be brought through an immersive experience that allows them to experience what it is like to receive neurotechnology therapy. In addition to learning more about the processes that are involved, the patients can also familiarise themselves with tips from past patients on how they may be able to more safely navigate use of this technology, e.g. refraining from certain exercises that may be damaging for the brain implant, etc. through superimposed text that appear on the VR simulated interface. Since this may be expensive, the CIN can engage venture capitalists who may be willing to subsidise the cost of the research and development involved. Hence, this will allow patients to use Neurotechnology more safely and allow for the successful continuation of such therapies.</p>	8 7 7 6 8	36



3	<p>(Technology) Bio Engineers and neuroscientists from CIN can work together to create a device that is made up of many miniscule components. These components can be created in the form of nanobots that can be controlled via a highly precise AI program that provides a real-time digital model of the person and the locations of the nanobots. These nanobots can be injected into a person's bloodstream when needed and travel to the person's brain via their blood. Once in the brain, these nanobots move through the blood-brain barrier and into the region of the brain where they are required, and self-assemble into the full device. The device can also be easily disassembled when issues such as unforeseen health problems arise or when it is no longer required into the form of nanobots which can then be removed from the body through natural bodily processes. This would allow any issues with the device to immediately be addressed and mitigated, and also make the implanting of the device less invasive and risky, hence improving the safety of Neurotechnology so that there can be the successful continuation of Neurotechnology therapies at the CIN in the USA in the year 2045 and beyond.</p>	3 1 4 3 3	14
4	<p>(Communication)The CIN can work together with engineers and scientists to create a microsensor which is embedded in flesh-like gel that can be inserted under the skin of the patients receiving Neurotechnology therapy by the CIN, in such a way that it is minimally invasive. This microsensor can be lined with receptors that are constantly testing blood flow for unusual hormone levels and able to detect abnormal nervous system behaviour. This is then wirelessly connected to the phone of these patients, which will receive constant electrical signals emitted from these microsensors and are then able to monitor their health and ensure that there are no malfunctions. If there are abnormalities in the performance of the Neurotechnology implants, the microsensor will alert the CIN immediately, who will then be able to provide proper medical help to the patients. Thus, this will allow patients to more safely use such Neurotechnology to ensure their successful continuation.</p>	4 2 5 4 2	17
5	<p>(Communication) CIN can work with the military to come up with a communication system between the implants, the commander's computers. The implants can detect the levels of physical exhaustion of the military officers by detecting the levels of lactic acid in their body. The implant will then communicate this data to the commanders so the commanders know how much adrenaline they can give to the officers without risking damage to their physical health. This ensures that the military officers can continue to use the implants for their training but will not suffer extensive damage to their physical health because of it, thus improving the safety of the Neurotechnology so that</p>	2 1 3 8 5	19

6	<p>(Law and Order) Government officials can work with neurotechnology experts and AI specialists to come up with an AI system that will gather feedback on the problems faced by users of Neurotechnology therapies in terms of safety and analyze this data to find the underlying problems faced. The AI system will then refer to current laws in the judiciary system to come up with potential laws that can be passed to mitigate the problems faced by the users. This can be in terms of ensuring fair access to neurotechnologies or transparency of data. Government officials will then evaluate all the possible laws and refine them so as to come up with a set of laws that will ensure of the safety of users using neurotechnology therapies so that there can be the successful continuation of Neurotechnology therapies</p>	1 5 2 5 6	19
7	<p>(Education) CIN can come up with an AI system that will create specialised courses for each individual, according to the neurotechnology that they use, and the organisations that have access to their neurotech data. The courses will educate the individual on the health risks of their neurotechnology and the level of access each organisation has to their data. This will increase the transparency between the users of the neurotech, neurotechnology companies and the organisations that use the data and ensure that the users are better educated about their own neurotechnology implants. This allows for better accountability for both the neurotechnology companies and the organisations that use the data, which will encourage them to increase the levels of safety in terms of the security of the users data. This will allow the users to have better trust in the neurotechnology therapies, so that there can be the successful continuation of Neurotechnology therapies</p>	5 5 1 7 7	25
8	<p>(Technology) Neurotechnology's Board of Directors can work with neuroscience doctors, engineers, and computer scientists to build a brain simulator that is able to accurately replicate any person's brain. Through AI and deep learning techniques, this VR brain simulator will be able to replicate how the person's brain may respond to new implantations and the removal/deactivation of previous implantations. This is so that doctors at the CIN will be better able to guide and advise patients on whether to go through with a certain type of implantation or use a different type of Neurotechnology safer for the patient's use instead, since different brains have variable responses to the same Neurotechnology.</p>	6 6 8 1 1	30

## STEP 6. Develop Action Plan

Develop your top-scoring solution idea into an Action Plan. Thoroughly explain how the Underlying Problem is solved, how the plan will be implemented, and how the Future Scene will be affected.

Q4 of 2045 Scout for relevant scientists, researchers, engineers within CIN and allocate them to work on the project. Interested parties or well-established professionals in the field outside of CIN can also be invited to work on the project to increase the diversity of input and innovation by introducing a greater number of perspectives. Identify relevant past patients of neurotechnology therapists, such as those who faced common problems of the technology or those who use a neurotechnology therapy that is widely implemented (for instance, due to the disease/problem being common, or the neurotechnology therapy being the most effective in addressing the problem). Thorough surveying will be done on these individuals regarding the experience they had and any data from their usage of their respective devices may be used for analysis after permission from these individuals are obtained. Commence research and development on the electrodes and VR simulation technology. This will include the possible effects on the patients' psychological and physical health so that doctors will be able to be prepared for how to deal with them and hence more safely use the Neurotechnology. Q1 of 2046 Small-scale testing to optimise and correct data collected so that improvements can be made to the initial prototype of the non-invasive electrodes. The testing may be done on both scientists to determine the accuracy of the depiction and the information included, and selected volunteers to test the simplicity and comprehensibility of the VR stimulation for the average person. Search for appropriate factories and source for materials that will be used to produce the new technology. Q3 of 2046 Confirm final funding from the venture capitalists scouted and the design of the final prototype before sending the confirmed design to factories for production. Relevant doctors and heads of medical institutes can start devising educational materials and training for doctors and nurses at the CIN on the usage of this novel technology so that they are better equipped with the skills to provide reliable support to the patients who will be using this simulator. Q1 of 2047 Learning operation of the electrode stimulated simulation by the doctors and nurses at the CIN so that they are able to operate the new devices safely. The Board of Directors will have to mandate the compulsory usage of the simulation in medical processes for all potential patients of neurotechnology therapy to go through before receiving the therapy to ensure that all potential users of the neurotechnology therapy are educated about how to safely use their neurotechnology devices and what are the potential risks involved should they stop using the devices. This will also encourage neurotechnology companies like CIN to invest in the safety of their product and also come up with ways to reduce the negative impacts when the users stop using the neurotechnology therapy devices. Thus this means that such a solution will not only be able to increase the safety of the neurotechnology therapy in the short term through appropriate education of the users, in the long term it will also spur companies to improve the safety of their product as users are now more cognizant of the risks involved. Impact By learning more about the processes that are involved, and familiarising themselves with tips from past patients on how they may be able to more safely navigate use of this technology, the patients will have more knowledge on how they can deal with the use of Neurotechnology at the CIN and also avoid actions that may jeopardise their safety with the Neurotechnology. This will allow the therapies to be safe for the patients and continue to be successful and effective. The introduction of this new simulator may also set a precedent for other Neurotechnology companies to design and implement safety measures and devices like the simulator to regulate the safety of the brain implantations. This will ensure that brain implantations all over the world are done in a safe and reliable manner. Effectiveness With the use of this simulation to ensure that the patients will more safely use the Neurotechnology, patients of therapy like Nikola whose implant has been deactivated and no longer interferes with her emotional responses will be able to be more prepared to deal with the subsequent side effects like a rise in stress levels and headaches, which will ensure that their health is not compromised and it is still safe for them. Moreover, this will also be able to resolve issues of consent and ethical violations as patients will have to be fully aware of what they are getting into and have to undergo the relevant consent procedures before they start Neurotechnology therapy. With the engagement of venture capitalists who may be willing to invest in and subsidise the cost of the research and development involved, it will also allow the Neurotechnology company to focus on the development of the product without sacrificing the quality of the simulator due to concerns of costs. This will better ensure that the simulator can achieve its intended objective of increased safety for the patient. Limitations and Obstacles As the simulation is based on past experiences of patients who have gone through Neurotherapy, it may be possible that there will still be unforeseen circumstances in which the patient's health may still be compromised. This would mean that the patients may still meet difficulties which they have not "experienced" before as part of this simulation and would be unprepared and likely less capable to deal with them. As the simulator is a sophisticated technology and is new to the market, it may be possible that the usage and upkeep of this technology is costly. This may be a problem as patients who are unable to pay for the costs of using this technology may not be able to benefit from the increased safety that this simulator is able to bring. Humaneness The technology is humane as it is largely non-invasive due to the usage of electrodes to stimulate the brain in a highly controlled environment and only after the patient has given them explicit and informed consent. Moreover, the device would give patients a more realistic experience of what having an implant would be like, hence improving the information and understanding of the technology that they have before making the decision to have the implant. Thus, this may even enhance their ability to exercise free will and the freedom of choice as they would not be unknowingly coerced into making a decision without knowing all of the facts.

Export