Role of Artificial Intelligence in Amyotrophic Lateral Sclerosis (ALS)

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Abstract: The role of artificial intelligence in amyotrophic lateral sclerosis (als) is all that means how the intelligence of a computer has helped to overcome the disadvantages of most evolving disease called ALS (amyotrophic lateral sclerosis). ALS is an amyotrophic lateral sclerosis is a progressive neurodegenerative disease that affects nerve cells in the brain and the spinal cord. A-myo-trophic comes from the Greek language. "A" means no. "Myo" refers to muscle, and "Trophic" means nourishment – "No muscle nourishment." The great scientist Stephen William Hawking (8 January 1942 – 14 March 2018) who was an English theoretical physicist, cosmologist, author and director of research at the centre of theoretical cosmology at the university of Cambridge. Hawking scientific works was focused mainly on gravitational singularity theories in the framework and the theoretical prediction that black holes emit radiation, often called hawking radiation He was the first to set out a theory of cosmology explained by a union of the general theory of relativity and quantum mechanics. Hawking was also an supporter of the many-worlds-interpretation of quantum mechanics. He is one of the ALS patients who as suffered for 50 yrs long. Stephen William hawking has been taken as perfect example to elaborate about the ALS disease. The disadvantages of ALS are muscle weakness, cramping, problems with coordination, stiff muscles, loss of muscle, muscle spasms, or overactive reflexes. It also affects the human speech vocal cord spasm or impaired voice. Also most common difficulty in raising the foot, difficulty swallowing. Hence Stephen William hawking had severe of these symptoms .that is he was unable to communicate with the people and he was also unable to walk. This is where the artificial intelligence of a computer comes to existence how actually technology helped him to reach his destination .the development of such a device took place where the device became a toothpick of Stephen hawking .that particular device helped hawking to talk what he wants to. Our main point is to explain how actually the device works and what are all the main advantages of this particular device

Keywords: ALS, Artificial Intelligence, Stephen Hawking

I. INTRODUCTION

A. Participation of Intel in giving voice to Stephen Hawking:

STEPHEN HAWKING FIRST met Gordon Moore, the cofounder of Intel, at a conference in 1997. He could notice that Stephen Hawking's computer in which he could communicate had weak processor and Moore asked him if he preferred "real computer" with Intel micro-processor. Intel Corporation has been providing Hawking with customized personal computers and technical support since then, replacing his computer every two years.

Hawking lost his ability to speak in 1985, when, on a trip to CERN in Geneva doctors managed to contain the infection hence to help Stephen hawking to breathe, they cut a hole in his neck by placing a tube into his windpipe. As a result, Hawking irreversibly lost the ability to speak.

First equlizer ran on an Apple computer which is linked to a speech synthesizer made by a company called this system was then adapted by David Mason, the engineer husband of one of Stephen nurses, to a portable system that could be mounted on one of the arms of a wheelchair. With this new system, Hawking was able to communicate at a rate of 15 words per minute.

However, the nerve that allowed him to move his thumbs kept degrading. By 2008, Hawking's hand was too weak to use the clicker. His graduate assistant at the time then devised a switching device called the "cheek switch." Which was attached to his glasses, it could detect a low infrared beam, when Stephen Hawking tensed his cheek muscle. From then Stephen Hawking has achieved the ability of composing emails, surfing through the internet, writing books and speaking using only one muscle. But still his ability to communicate continued to decline.

Stephen device interface was a program called EZ Keys, it was an upgrade from the previous software . It provided him with a keyboard on the screen and a basic word-prediction algorithm.

Algorithm called predictive-word and next-word navigation, would let him choose words one after another rather than typing each of them.

Intel came up with certain changes they felt it would not suddenly change how hawking used his system, but it would have a large impact . further changes included additions such as a "back button," which helped Stephen could navigate a step back in his user interface. predictive-word algorithm and next-word navigation algorithm, was used to address the missed key-hits, the Intel corporation

added a prototype that would interpret Stephen's intentions, rather than his physically expected input by using an predictive word and certain preferable algorithms .

In the month of June , Stephen hawking visited Intel Labs, where Denman and his team introduced him to the new system, called ASTER (for Assistive Text Editor).. he has changed the method by which next-word prediction works and it can pretty much pick up the correct word every single time, even if you're letters away from that particular word."

It was a big improvement over the previous version from the Intel Corporation

During 2012, the Intel team set up a system that recorded how Hawking interacted with his computer. The group of Intel Corporation has recorded tens of hours of video that encompassed a range of different situations.

The enhanced version of hawking user interface called as Assistive Contextually Aware Toolkit which includes contextual menus that provide Stephen hawking with various shortcuts to speak, search or email and it also gives him control over the timing of his delivery during talks. It also has a mute button, curious feature that allows Hawking to turn off his speech synthesizer. "

One wall is heaped with electronic hardware and experimental prototypes. Mounted on the desk is a camera, part of an ongoing project with Intel.

Hawking is very attached to his voice: in 1988, when Speech Plus gave him the new synthesizer. His voice had been created in the early '80s by MIT engineer Dennis Klatt, a pioneer of text-to-speech algorithms. He invented the DEC talk, one of the first devices to translate text into speech.
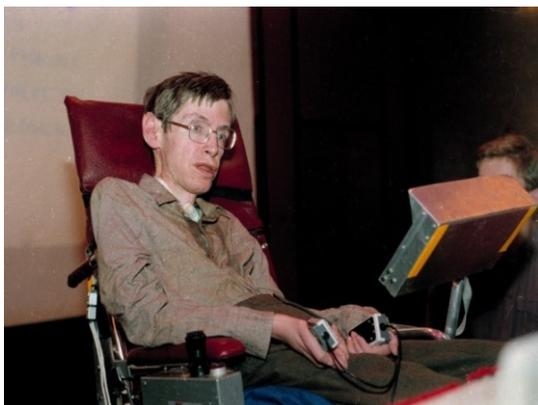

Fig 1.   Stephen William hawking with his equalize

II.   DESIGN

How Did Stephen hawking's Communication System Work?

Stephen Hawking talked through 'the computer', using a speech-generating device (SGD) or a voice output communication aid. This is a special device that either supplements or replaces speech/writing.

To give a bit of quick background, Steven Hawking was a British cosmologist and physicist most famously known for his notable scientific works regarding the theoretical prediction of radiation emission from black holes (Hawking radiation), Penrose–Hawking theorems, the general theory of relativity and quantum mechanics. He also authored A Brief History of Time, a popular bestseller that discusses the Big Bang and black holes.

Apart from these accomplishments, there's one more and a rather unfortunate thing that he was commonly known for: he had amyotrophic lateral sclerosis (ALS). Also referred to as motor neuron disease in some countries, it involves the death of neurons in a patient's brain. It results in muscle twitching and a gradual deterioration of muscles that leads to difficulty swallowing, speaking and eventually breathing.

Therefore, Hawking used a number of gadgets to give lectures and communicate with people, since he no longer had the ability to speak as most people do. You have almost certainly seen him in photographs and footage sitting in a wheelchair with a few different machines attached to it.

Let's check out some different parts of the machinery and explore how they helped Hawking disseminate his brilliance through words to the entire world.

The machine that enables Stephen Hawking to communicate What Hawking used to communicate is aptly named a speech-generating device (SGD) or a voice output communication aid. This is a special device that either supplements or replaces speech/writing for people who have problems communicating in a traditional way. Hawking had been using this computer based communication system made by Intel Corporation since 1997. The entire computer system was replaced every two years to cope with the gradual loss of control over his muscles over time.

Hawking had actually written a small post titled 'The Computer', where he briefly talked about the tools that helped him communicate.

A. Speech-Generating Device

Intel had released Hawking's speech system, i.e., Assistive Context-Aware Toolkit as open-source code for the general public to make tweaks and tinker with so that it can become more suitable for a wider range of communicative disabilities.

B. Feeding Information To The System

Hawking's communication system had three major components. First was the input, which also happened to be the most challenging element in Hawking's case. Like many other ASL patients, he had little Science ABC Nature Humans Tech Pure Sciences Eye Openers Social Science Popular Nature

Humans Tech Pure Sciences Eye Openers Social Science Popular control over his muscles, which means that he couldn't just type out words or click some buttons (which, by the way, he was able to do when his condition

was better initially) to input the information. He needed a different, more sophisticated way to feed information into the computer.

Fig 2.   Stephen hawking speech generating device

This was achieved by an infrared switch mounted on his spectacles that caught the slightest twitches or movements in his cheek. When his condition was better earlier in his life, he used to press a clicker using his thumb for input. However, he eventually lost control of the nerves that controlled his thumb muscles, and had to use other methods of input, hence the infrared switch that traced movements in his cheek.

C. Interface

The next part involves forming words using the input from the infrared switch. This interface is a program called EZ Keys, developed by Words Plus Inc. It provides a software keyboard that's displayed on a tablet computer and mounted on one arm of his wheelchair, which is powered by the wheelchair batteries.

The software moves a cursor across the keyboard by either moving through columns or rows. When it reaches the desired word, Hawking could stop it with a twitch of his cheek. Individual letters were selected in this way to form words and then sentences. Furthermore, EZ Keys also let him move the pointer in the Windows computer that he used.

To make things easier still, the software also included an auto-complete feature – very similar to what we have in smart phones and tablets – that predicts the word without requiring Hawking to complete the spelling of the entire word.

Output: Talking out loud

The last part, and probably the easiest one, is speaking the complete sentence out loud for this Hawking used a speech synthesizer (developed by Speech+) that spoke the sentence once it had been approved or completed. However, it did have an unmistakable accent, which had been diversely described as American, Scottish or Scandinavian.

This machine didn't just let him talk, but also allowed him to do plenty of other tasks as well, including checking his email, browsing the Internet, making notes and using Skype to chat with friends. Intel had a dedicated team of engineers that was working on improving his communication system even further and enhancing the number of tasks he could perform. All in all, Hawking could give lectures and interact with people without much difficulty using this communication system.

Unfortunately, Hawking passed away in the morning of on March 14, 2018 in Cambridge, England. He was 76 years old.

III.   APPLICATIONS

Amyotrophic lateral sclerosis (ALS) is a group of rare neurological diseases that mainly involve the nerve cells (neurons) responsible for controlling voluntary muscle movement. Voluntary muscles produce movements like chewing, walking, and talking. The disease is progressive, meaning the symptoms get worse over time. Currently, there is no cure for ALS and no effective treatment to halt, or reverse, the progression of the disease.

Messages from motor neurons in the brain (called upper motor neurons) are transmitted to motor neurons in the spinal cord and to motor nuclei of brain (called lower motor neurons) and from the spinal cord and motor nuclei of brain to a particular muscle or muscles.

In ALS, both the upper motor neurons and the lower motor neurons degenerate or die, and stop sending messages to the muscles. Unable to function, the muscles gradually weaken, start to twitch (called fasciculation), and waste away (atrophy). Eventually, the brain loses its ability to initiate and control voluntary movements.

IV.   CONCLUSION

The disadvantages found on ALS can be overcome by the Intel corporation by providing the device called speech generating device .It helps the person to communicate who is not able to communicate directly.

The device takes the input information and transfers the generated keyword or the complete sentence to the speech generating device finally the speech generating device speaks out loudly.

It was honor for the Intel corporation to help the great scientist Stephen William hawking to make his dreams come true.

People suffering from this dangerous disease will have the problem in speaking and even swallowing .there is not yet a proper remedy or a solution for this disease and there are several researchers who are working on this generative disease.

Hence there is no medical support for these patients who make their voluntary muscles work and stop there nerve cells dying but medications can be given of survival.

But the technology has helped the great professor and scientist to speak and communicate with the people with

the use of speech generating device .This is the main tremendous advantage of SGD.

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