application called *EyeNote* can communicate the value of paper money via tone, vibration or spoken word that is a real aid for blind individuals during making purchases or transactions [1].

There is also a complementary addition to the reader – the Braille display – a special kind of keyboards. Its duty is to display in Braille the same information which is announced with the oral speech. In practice, this means driving a Braille output device - a row of Braille cells with mechanical pins that pop up and simulate Braille characters under the user's fingers - or, more commonly, a text-to-speech synthesizer [2]. In complex, these assistants provide users with better information about the layout of the screen, possible actions and your current position on a website.

Increasingly, companies are realizing that expanding Internet accessibility for people with disabilities provides a range of business benefits. The survey results show that investment in accessible information and computer technologies gives the opportunities to achieve such business goals as: opening up new markets; maximization of employee engagement and productivity; providing high quality products and services; improving of supply chain management; minimizing risks of litigation. One of the most important aspects in service, especially online, is its affordability. Companies should focus on flexible design and promotion of assistive technology. For instance, some Internet pages have a version for blind people. Moreover, perfect idea is to install a special voice assistant or a call-button. By clicking this button a person could activate an info-bot, which will sound information tabs available on a site. One more advantage of such service is the opportunity to put voice question to the bot and have answers immediately, actually not only answers, but also instructions about the following actions. Providing flexible design (‘design for all’) means that no more additional devices are needed.

From the presented above analysis we can conclude that technology is playing a vital role in tearing down barriers, and artificial intelligence is making real inroads into improving accessibility. As a result, people with disabilities have access to plenty of assistive services which help them fully participate in social life and connect to the world.

References

1. Top 10 Apps for Visually Impaired People. URL : https://eye.keckmedicine.org/top-10-apps-visually-impaired-people/ (Last accessed: 26.10.2021).
2. Reeta Singh. Blind Handicapped vs Technology : How do Blind People use Computers? International Journal of Scientific & Engineering Research, Volume 3, Issue 4, April-2012.

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HYDROGEN ENGINES: A TECHNOLOGY OF THE FUTURE OR AN INEFFECTUAL EXPERIMENT?

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The question of alternative energy source for vehicles has been acute for the last few decades. Electric cars are the most popular offering of the modern industry but not the only one.

The purpose of this article is to analyse the advantages and disadvantages of hydrogen engines. Vehicles based on hydrogen combustion engines became as accessible as never before. For example, in 2007 *BMW* has launched limited car series called ‘Hydrogen 7’. The first serial model was launched by Toyota in 2014 and was called ‘*Mirai*’.

Figure 1. *Electrovan*

The first vehicle with hydrogen fuel cells was ‘Electrovan’ (Fig. 1) made by *General Motors* in 1966. It was equipped with hydrogen reservoirs which allowed to ride up to 193 km per single charge [1]. However, it wasn`t put into production and was only build in one copy. The first vehicle with hydrogen engine was build in 1979 by *BMW* due to oil crisis in 1970-s but it also wasn’t put into production [2].

In spite of the fact that this technology has lots of advantages over conventional combustion engines it is not so perfect as it seems.

Hydrogen engines are often fairly compared to electric engines as both of them were developed to be an alternative to combustion engine. Their main feature in a line with electric engines is eco-friendly working process. Another advantage lies in hydrogen engine’s efficiency which is 10% higher compared to conventional combustion engines. It means that a vehicle with a hydrogen engine can ride the 2,5-3 times longer distance using only 1 kg hydrogen that is equal in energy intensity and volume to 1 gallon of petrol.

Nowadays every city has a high noise level, especially near main roads, because of the large number of cars using combustion engines. Hydrogen engines are completely silent that is an undeniable advantage and would make cities much more quiet. The last but not least feature is the faster refueling compared to an electric vehicle.

In spite of the number of the mentioned above advantages hydrogen engines also have many

Figure 2. *Toyota Mirai* and *Nissan Leaf*

issues. For example, despite the exploitation of any hydrogen engine is fully ecological friendly, the hydrogen manufacturing process creates noticeable pollution. Also, a hydrogen vehicle is more expensive than a petrol one: *Toyota Mirai* costs 66900€ which is twice more compared to petrol or hybrid model’s average prices [3]. Hydrogen cars are more expensive even compared to electric cars (*Nissan Leaf* (Figure 2) costs approximately 35000$) [4]. Moreover, electric energy is much more accessible and cheaper than hydrogen fuel.

Another disadvantage is that hydrogen is very volatile that makes hydrogen engines quite dangerous. In case of engine tightness loss hydrogen will quickly exude and cause a powerful ignition or even explosion. Such disadvantages also influence infrastructure issues: hydrogen fuel stations are expensive and dangerous, so they are quite poorly distributed even in Europe or USA. In Norway, for example, hydrogen fuel stations were banned since 2019 due to the accident in which hydrogen station exploded.

Despite the fact that hydrogen engines can be a worthy alternative to usual combustion engines and even electrical engines, one might say that such type of engine won’t replace electric and combustion engines. Moreover, taking into consideration electric vehicles spread rate it may be

possible to suggest that there will not be any demand for hydrogen cars. On the other hand, hydrogen engines may be used in portable power generators instead of petrol ones. Such replacement can slightly reduce their mass and sizes without any loss in efficiency. Besides, hydrogen power generators are also eco-friendly, noiseless and are able to generate thermal energy as well.

To sum up, hydrogen engines is the quite worthy technology that can stand in a row with combustion and electric engines, but the technology entails considerable expense and problems with infrastructure and safety. Even if this technology will not be used in cars, it could be a good alternative to petrol or diesel power generators or may be even used for power plants.

References

1. 1966 GM Electrovan Fuel Cell Prototype Turns 50. URL: https://www.motortrend.com/news/1966-gm-electrovan-fuel-cell-p (Last accessed 24.10.2021)

2. Как работает водородный двигатель и какие у него перспективы. URL: https://trends.rbc.ru/trends/industry/6048e0629a794750974c67a7 (Last accessed 24.10.2021).

3 Mirai Premium - Седан 4-дверный. Основные характеристики. URL: https://ru.toyota.ee/new-cars/mirai/index.json (Last accessed 31.10.2021).

4 Nissan LEAF. 100% Технологичный электромобиль. URL: https://ru.nissan.ua/vehicles/new-vehicles/leaf.html (Last accessed 31.10.2021).

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ADVANTAGES AND DISADVANTAGES OF WIND POWER PLANTS

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Environmental preservation is one of the most important issues for modern society. This is why most companies that specialize in generating electricity switch to sustainable and environmentally friendly power plants, among which the most popular are wind power plants. Wind power plants have significant advantages over the solar panels and power plants, which operate on natural gas [1].

1. The most obvious advantage is complete autonomy of the station and its independence from the centralized networks. There is no need to monitor or supervise their operation.

2. The plants are environmentally friendly because wind is a renewable resource and its treatment does not cause harmful emissions into the atmosphere, land and wastewater as produced by oil, whose emissions produce nitrogen oxides and carbon dioxide, which are hazardous not only for the environment but also for people.

3. Power batteries take up little space, so they are more convenient than solar batteries, which take up a large amount of territory. They can be placed both on dryland and offshore where the speed of wind is much higher.

4. Low water consumption for power generation is a very important advantage. Because of this, wind turbines can preserve the global supply of fresh water, which became an important issue worldwide and is one of the Sustainable Development Goals listed in The 2030 Agenda for Sustainable Development, adopted in 2015.

5. Wind stations are long-lasting. They will be in operation for years due to an insignificant amount of wear and tear of the mechanics and structural elements.

6. Another important reason is providing excellent employment opportunities for the area's population [2].

However, wind power plants also have a number of disadvantages, listed below [3].

1. Their operation depends on weather conditions. Wind is an inexhaustible resource, and wind power plants are able to generate electricity around the clock. However, in some cases there is not