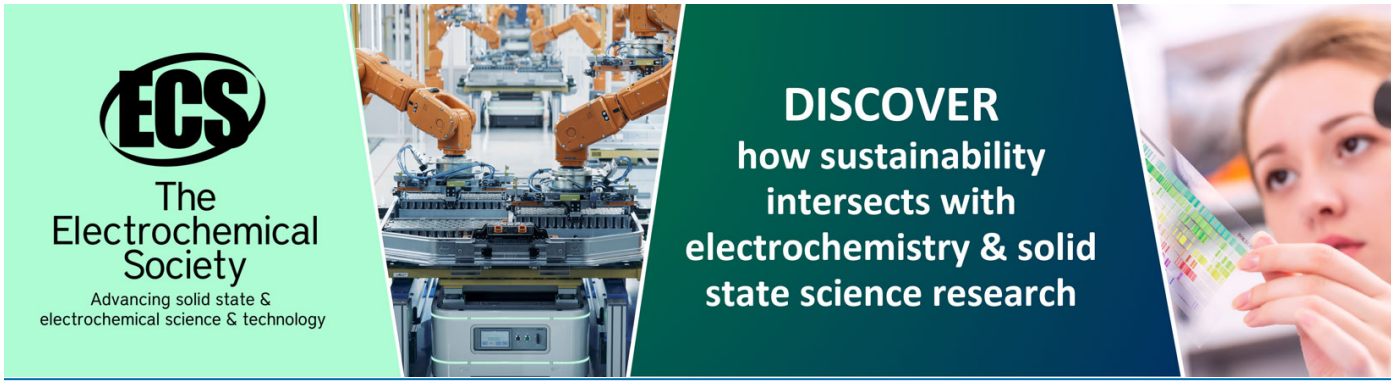
Characteristic barriers to the implementation of the roadmap for augmented reality technology development program



Characteristic barriers to the implementation of the roadmap for augmented reality technology development program

V Zhmud[1], A Liapidevskiy [2] and V Avrmachuk[3]
[1] Department of Automation, Novosibirsk State Technical University, Novosibirsk, Russia
[2]General Director of Novosibirsk Institute of Program Systems, Novosibirsk, Russia
[3] Department of Complex Information Security of Computer Systems, Tomsk State University of Control Systems and Radioelectronics, Tomsk, Russia
E-mail: oao_nips@bk.ru

Abstract. The paper gives the author's vision of what the main barriers to the creation and implementation of new technologies in the field of virtual and augmented reality may exist during the implementation of the Digital Economy of the Russian Federation program. Since some of the authors took part in the development of roadmaps for this program, there is a two-sided vision of the problem. Authors can put themselves in the shoes of both the funding organization for this project and the campaign that is developing concretely in this area. Almost two years have passed since this program was launched. The conclusions of the article can be useful both for organizations funding this program and for grant recipients

1. Introduction

The program "Digital Economy of the Russian Federation" was launched in 2019 [1]. At the same time, nine roadmaps were being developed in accordance with the nine main areas of technology [2]. One of the most relevant areas is the direction of virtual and augmented reality. These two terms traditionally go together, although it seems that it is high time to separate them despite the fact that they have much in common [3].

The fact is that virtual reality has long entered a stage of development that does not require centralized government support. This is because the industry is already making a steady profit. Another explanation is that even small results in this area have independent commercial significance, therefore, there is no need for relatively large investments in order to overcome such a barrier that cannot be overcome gradually.

In this article, we will consider the main problems of the development of augmented reality in our opinion, and we will talk about virtual reality only because of the close connection of some technological solutions with this main and most difficult task.

2. Statement of the problem

Virtual reality is now known to almost every child, even not yet a schoolboy. The abundance of games played on the phone, tablet and computer allows you to keep your child busy and thus free up time for parents for personal affairs. This, of course, is a great advantage of our time, but there is also a disadvantage of this situation. Although now it is very often said that children have become addicted to these computer games, as well as from virtual communication with real or virtual friends, but few people notice that it was the parents who were the first to get into this addiction. Indeed, it is much easier for them to give the child a game and get the desired free time than to entertain the child personally. Further,

the parents believe that the process of preschool education can also take place without their substantial help; it is enough to address the child to the corresponding Internet pages. The problem is getting out of control due to the fact that school teachers themselves often use sources from the Internet when preparing for classes, and schoolchildren do the same. This process is carried over to universities: teachers have tremendous opportunities to download textbooks, including those subjects in which they need to teach, and students have the opportunity to download ready-made abstracts, term papers, and diploma works. The humorous forecast of the Polish satirist Stanislaw Lec that "humanity will soon be able to do well without itself" is being implemented in practice.

Along with this unpleasant feature of the present time, which consists in the fact that people can receive all the necessary forms of communication without the help of other people, and with the help of Internet technologies and virtual reality technologies, one cannot deny the benefits of this. Indeed, in our time the world is faced with the fact that in critical situations, professional help may be delayed, or even be inaccessible to most of those people who urgently and urgently need it. So, for example, the arrival of ambulance teams, which according to the regulations should take place within 20 minutes, in a pandemic is delayed by a day or more. But the arriving doctors often carry out a standard survey and prescribe standard sets of drugs, so it turns out that in some cases there was no need to wait for real doctors, virtual doctors could cope with this task, who would question the patient about the symptoms and prescribe at least harmless treatment. Also, some examination methods can be done remotely, since there are fully automated devices not only for measuring temperature, but also for measuring pressure, pulse, apparently, it is not difficult to make the same devices for measuring other most important indicators of health. For example, it is not necessary to be present in person to see a white coating on the tongue or an icteric skin color, and so on. Thus, we can say that the use of virtual reality technologies could go much further if it were combined with technologies for remote data collection and processing, with technologies for measuring parameters of physical objects. And such a connection is element of augmented reality technologies.

Augmented reality technologies are that they not only allow the user to immerse the user in a fictional world, which is formed by the methods of computer creation of sounds, images, tactile sensations, possibly also heat, aroma, air movement, changes in humidity (including splashing water), a change in the sense of gravity by accelerating the cockpit with the user, (which makes you feel like you are in almost any fictional world). Augmented reality technologies should allow this to be done not under the condition of complete disconnection of the user from reality, but by combining his sensations of reality along with the sensation of the generated virtual reality. Such technologies do not completely deceive the user's feelings, but only partially, adding additional sensations to the correct ones. Science fiction has shown a lot of examples of augmented reality, but practice is still far from achieving such effects. Some effects, perhaps, will remain fiction, others are likely to be widely implemented in the near future.

For the correct choice of financed areas, it is advisable to understand, firstly, what exactly we want to finance, and secondly, how exactly promising projects should be selected, to distinguish them from unpromising ones.

3. Some non the main directions

We believe that government funding for the development of science is not always necessary. Apparently, if a direction can develop from itself, independently, then financing from outside, of course, can accelerate this development, but it is not at all a necessary condition for such development. For example, when the United States channeled money to pay unemployment benefits in an attempt to quell the first wave of the crisis in the early twentieth century, it not only did not help, but only exacerbated the crisis, because free money never promotes the development of industry and technology. Because people who were not employed in production began to receive money for nothing, people employed in production had to create material values both in order to feed themselves, their families and their employers, but also in order to feed these unemployed. Napoleon Bonaparte approached this problem in a completely different way. In order to develop the textile industry in France, he supplied money not to manufacturers, but to customers, that is, he allowed the upper classes of society to enrich themselves, at the same time

obliging them to spend huge sums on luxurious clothes, carriages and other items that were products of the domestic industry. Apparently, this approach has a right to exist, despite the obvious violation of the ideals of social equality and justice. Transferring this experience to the modern situation, it can be argued that for the development of certain technologies, instead of giving gifts to those who can develop these technologies, it is necessary to create conditions for those who can buy services obtained with the help of these technologies to buy such services would be more and more.

As for augmented reality technologies, the difficulty of their development is that they use too many other related technologies, so they cannot be sufficiently developed by individual small groups of enthusiasts, representatives of small and medium-sized businesses. Big capital will flow into this area only when it is obvious that profits in this sector have become greater than profits in other sectors. If virtual reality technologies can develop gradually, then augmented reality technologies in such a state, when they will bring obvious profit, are at a distance from the current situation in Russia by such an amount that can be figuratively described as an “abyss”. And as you know, it is impossible to jump over the abyss in two jumps. One "leap" is needed, one breakthrough stage, after which these technologies will start to pay off steadily. It is for such disruptive technological developments that government funding is the only effective way to solve the problem. Only the state can afford to finance the development of such technologies that cannot pay off in the next two or three years, but will pay off only after large capital investments. In this area, we see some not entirely correct approaches that are found in the statements of some experts who participated in the creation of roadmaps on virtual and augmented reality.

3.1. Display manufacturing

An erroneous emphasis on the quality of the visual picture, that is, attempts to drag funding to the production of higher-quality displays for displaying generated images. Undoubtedly, the quality of video image formation is a rather important property of available technologies, but this direction has been successfully developing for many years; for its further development, there is no need to class it as a specific digital technology, which should be financed from funds for the development of virtual and augmented reality. Billions of people use televisions and computers, phones and tablets, all of these devices use displays created using approximately the same technologies. Thus, there are already those who will pay for the best quality of these products. There is a market, there is a consumer, there is a sufficient supply of funds to purchase better quality goods. These technologies can be developed without government support.

3.2. Production of new audio systems

There are also quite a lot of consumers of sound equipment in the world, and there are enough connoisseurs of high-quality sound. Therefore, if the manufacturer creates loudspeaker systems of higher quality, there will be no problems with the market. Therefore, the inclusion of sound generation technologies in the list of virtual reality technologies is a mistake.

3.3. Wireless data transmission technologies

These technologies are a separate area of the Program development. Of course, they will be in demand in the direction of the industrial Internet of things, and in the direction of robotics and sensorics, and in the field of computer intelligence and neural computing. Virtual and augmented reality technologies should be developed autonomously, considering that the technologies listed above will develop on their own, and by a certain meeting point in the future they will already be at a new technical level that will be used in these technologies too.

4. Some main goals

Augmented reality technologies should be distinguished by the feature that they allow the formation of some virtual reality objects on real objects, which are not, for the most part, objects specially prepared for the formation of this virtual reality. Along with the fact that you can look at reality through some

special glasses, or a screen, or, for example, aiming the smartphone camera at this object and observing it directly on the smartphone screen, virtual reality technologies in the daring dreams of science fiction writers present completely different possibilities.

On the Internet, you can already find video images that demonstrate technologies that do not yet exist in such a form as if they already exist. Such videos are fabricated by computer methods of combining reality with digital animation. Almost all fantastic films, and not only fantastic ones, have been shot using these methods. These films show images that are formed simply in the air, without the use of any additional media. These can be images of computer diagrams, drawings, interactive screens, as well as supposedly holographic images of living people, which outwardly do not differ from real people. Unfortunately, these technologies are still unrealistic. Some kind of light reflectors are needed to form an image in air. These can be splashes of water, blades of a fast-rotating fan, smoke particles, dust particles, aerosols, and so on. Since the human eye has a short-term memory, it perceives a short but bright flash as a constant glow, reacting to the average value of the brightness of the light. Therefore, an effect can be obtained in which the eye sees a real situation, against the background of which it also sees a picture, consisting of many bright points, from which an integral image is formed. But in order to make a certain point in space glow, it is necessary that it contains some object reflecting or scattering light, even a point one. In clean and transparent air, a luminous point can be created only due to very powerful radiation, which is very sharply focused only at this point, but this method of forming a hologram already poses a serious danger to the eyes. Another way is to use virtual reality glasses. But the method with glasses, screens, fountains, propellers and aerosols has long been implemented in many mass-produced devices. Therefore, before financing developments in this direction, it is necessary to understand exactly what it is proposed to finance, and what result is expected to be obtained, how breakthrough it is.

Sound shaping technologies can also contain fundamentally different methods. For example, sound can be shaped using light, remotely, and not only shaped, but also transmitted over long distances at the speed of light, and not at the speed of sound. In this case, no speakers will be used, the sound can be formed directly in air, or on the surface of a solid or liquid body due to periodic thermal expansions and contractions of individual volumes of the medium or surface. If we talk about the formation of sufficiently loud sounds directly in the air, then these technologies can also pose a danger to human health. In addition, the technologies discussed above, if they are associated with the use of laser technology, require ideal visibility from the transmitter to the place of image or sound formation, that is, any shielding will disrupt the formation of augmented reality objects.

Measurement and perception of the surrounding reality is very important. In this case, it is necessary to additionally process the actual picture of reality in order to obtain a digital twin of the subjective picture of reality perceived by the subject, since the virtual additional image must be superimposed on this real picture so harmoniously that the perception of these two different types of reality is carried out as a single reality. With the inept creation of augmented content, it is possible to overload the user's psyche so that, instead of helping, such a combined reality will destroy his psyche. There will be many technical and psychological problems on the way to implementing augmented reality. The developers of the roadmap paid great attention to legislative problems, but it can be argued that to eliminate legal “slingshots” does not require a lot of funding. These problems should be solved with the help of management resources, and not with funding. After all, the state will not buy off its own legal services to eliminate obstacles to economic development using digital technologies. And if the solution to the problem does not require state funding, then this problem is not a task that should be solved with the help of a program whose only toolkit is targeted financing.

5. Preferences for small businesses

The program was initially aimed at executors concentrated in small and medium-sized enterprises. The initial conditions of the competition did not allow large enterprises to participate in the competition. This, of course, is not correct. Later, the competitive conditions were adjusted. Small businesses are usually created with the aim of improving the welfare of their creators. The development of science-

intensive technologies, bringing them to real products, making a profit is too long a process in which small enterprises, as a rule, do not participate.

Most often, small businesses are created on the basis of an existing scientific groundwork with the aim of commercializing it. Often, the core of these enterprises is a group of developers who have spun off from a large research and development enterprise on the grounds that they have all the necessary knowledge to use the idea that was generated during their work in the enterprise. This enterprise paid for both the first experiments and the creation of the first product samples, but it is not aimed at commercializing such ideas. In addition, the commercialization of ideas in a large enterprise does not bode well for the team of authors, and therefore it is separated into a separate small enterprise. At least in the economy of the Russian Federation, such a scheme was carried out quite often. A small business cannot provide co-financing for its development. A small business cannot provide all the staffing requirements for the development of a new technology. The only thing a small business can most often do is to quickly gather a sufficient team of programmers around it, provided that they are provided with higher salaries than in a large campaign.

The condition of obligatory co-financing in the amount of at least 50% of the cost of the work seems unreasonable. If the research results are a new technology that is in demand by the state economy, then it is not clear why to limit the selection of performers only to such teams that can cover half of the costs from some other sources. Apparently, this requirement is a desire to hedge, which is natural in the event of a shortage of independent and highly qualified experts.

It also seems strange to require that the team of performers have publications in high-ranking journals, and that the main performers have scientific titles and scientific degrees. In addition, one of the requirements that is almost always set for competitive funding is a small average age of the performer team. It is clear that if the average age of performers is 65 years old, one can hardly expect breakthrough digital technologies, but what does not suit the team in which, mainly, for example, programmers aged 45-55, work, it is not clear.

It is also not serious to demand that the team, which received funding, began to issue products by the end of the current calendar year. It turns out that in a few months the recipient of financing must not only create a fundamentally new technology, but also introduce it into production, and get some kind of fundamentally new product. It seems to us that the average statistical team aimed at creating a truly new technology, most likely, will not be able to provide co-financing, will not meet the requirements for publication activity, for age criteria, for scientific titles and degrees of performers. This means that in order to win, this team will make a deal with an enterprise that can provide financing, will include people with appropriate indicators in the team.

That is, we see that these requirements, at first glance, are aimed at saving public funds, because if the winner of the competition adds their own funds in the amount of 50% of the cost of the work, then the state will receive research results for half the price. But in fact, the process will go in the opposite direction, because in order to create a tandem with an organization that will provide co-financing, the real performer will have to attract her with something. And it can be attracted only by the fact that this organization will receive more money from the project than it will provide. That is, the condition for providing financing does not actually increase the amount of money for development, but decreases it. For example, if the cost of development is indicated as 200 million rubles, and at the same time the contractor indicates that he will receive half from the co-financing organization, then this means that in fact the contractor intends to spend on the work itself an amount that is less than half of the indicated cost, since half , received as co-financing, he will definitely have to return, as well as add some kind of "bonus", for example, he will attract 50% of the amount, and return 60% to the benefactor, that is, only 40% will remain for work, which is 80 million rubles. So, wouldn't it be easier to allocate 100 million rubles to this enterprise without any requirement for co-financing?

If an organization that has entered into a competition for funding includes some doctors of sciences with important publications in the list of executors, and some students to reduce the average age of the team, then these extra people will have to receive their share of funding at least for agreement to be listed in this team. This again means that some of the money will not go to the purposes for which the

program was created, but wasted. Consequently, the wrong list of achievements and indicators of the contestants is simply unnecessary costs, unnecessary obstacles for a truly effective team and unnecessary opportunities for various combinator-manipulators to get involved in the division of money.

6. Creation of leading centers

The creation of leading centers assumes that these centers will carry out competitive selection locally in the regions. If we talk about science-intensive technologies, this suggests that there is an understanding that there is, for example, Siberian science, or Far Eastern science, or Ural, or Moscow, and so on. Apparently, the attraction of regional experts to finance the development of technologies for regional projects was meant to maintain some semblance of fairness. Apparently, not all the money should be left in the two capitals, this fact has already been understood. But instead of changing the conditions of the competitive selection, excluding corruption components, it seems that it was easier to split funding into territorial quotas. This gives hope that some funds will be shared impartially.

7. Conclusion

This paper provides some alternative views on funding research in virtual and augmented reality. Probably, one of the main problems in the implementation of the Program is not so much a lack of competent experts in this area, but a lack of trust in truly competent experts from among domestic specialists; instead, high-rated journals enjoy trust. We must first answer the question of what we want to receive as a result of financing the Program - an additional number of articles with a high quartile, or actually working technologies for the production of new products, even if not a single new paper is written about them.

References

[1] "Digital Economy" Program Implementation. Available at: https://ac.gov.ru/en/projects/project/digital-economy-program-implementation-42
[2] Report on the digital economy development in Russia. Competition in the digital age: strategic challenges for Russia. Available at: https://roscongress.org/en/materials/doklad-o-razvitii-tsifrovoy-ekonomiki-v-rossii-konkurentsiya-v-tsifrovuyu-epokhu-strategicheskie-vyz/
[3] Russia Moves to Fund Digital Economy in Five Sectors. Available at: https://www.russia-briefing.com/news/russia-moves-fund-digital-economy-five-sectors.html/