



## MOBILE APPLICATION AND VIRTUAL LABORATORIES WEBSITE FOR PHYSICS TEACHERS AND HIGH SCHOOL STUDENTS

**Makhzuna Qorjobova**

Tashkent State Technical University mahzunaqorjobova@gmail.com  
973175111

**Yunus Turayev**

Tashkent University of Applied Sciences yunus.cs.u@gmail.com  
977161690

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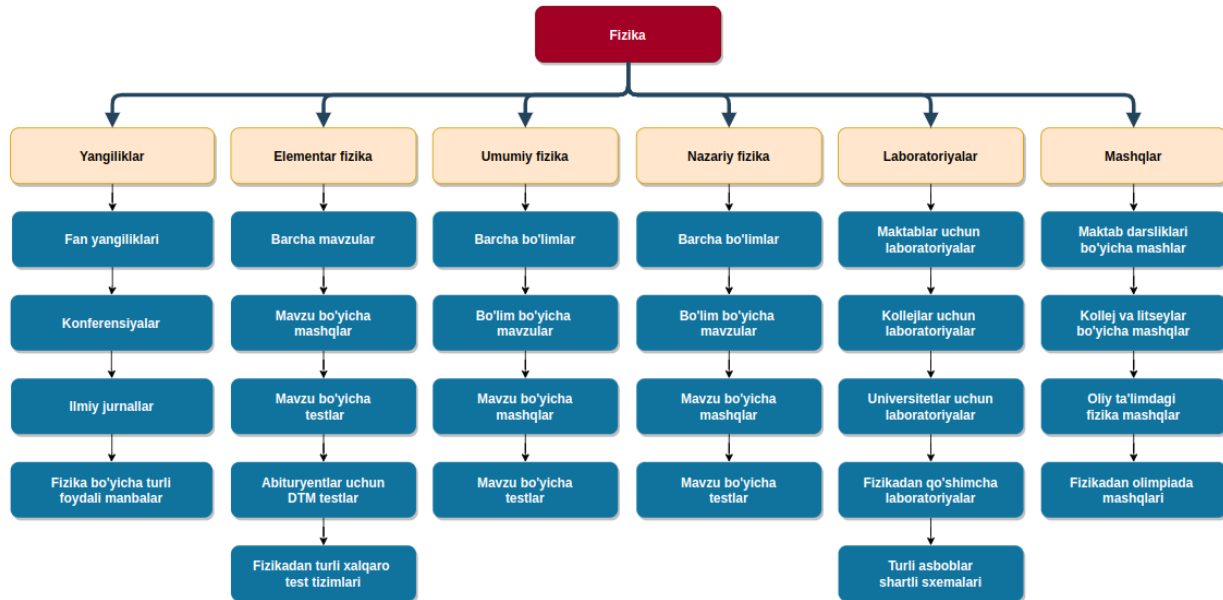
### ABSTRACT

*This article explores the importance of developing online virtual laboratories and a mobile application to enhance the learning experience of secondary school students studying physics. We discuss the implementation of these technologies, and their proposed structure, and offer suggestions for their use. The need for virtual laboratories and mobile applications is increasingly evident as traditional educational methods struggle to keep up with the demands of modern students. By creating interactive, multimedia learning tools, students can better understand complex scientific concepts and perform virtual experiments without the limitations of traditional laboratory settings. we propose that virtual laboratories and mobile applications be designed with a user-friendly interface, engaging multimedia content, and interactive features to promote self-directed learning and critical thinking skills. Ultimately, the implementation of online virtual laboratories and mobile applications will enable students to learn physics in a more accessible and engaging manner.*

**INTRODUCTION.** Why is it necessary to develop mobile applications in physics (and in all subjects in general) and what are their benefits? Currently, almost 100% of secondary school students (from grade 5 and higher), college and lyceum students, students, and even professors and teachers in universities use mobile smartphones, with almost 80% of them using Android devices. Therefore, if the materials (lecture texts, textbooks, slides, etc.) for a subject are placed in a mobile application, it would make learning and teaching much more convenient for learners and educators, allowing them to acquire knowledge in that subject at any time and any place. In addition, if the Ministry of Education includes a section for the latest news and updates related to the subject, it would also provide an opportunity for the mobile application to be constantly updated. In section 2, detailed information is provided on the proposed mobile application for the physics subject. Furthermore, we have also discussed

the necessity of creating virtual physics laboratories in the secondary education system, their advantages and disadvantages, and how they can be implemented (refer to section 4).

**II. MOBILE APPLICATION OF PHYSICS.** Students of secondary school, students of Higher education, teachers, and even scientific researchers will find our proposed mobile application very useful. Its overall scheme (initially depicted in the following image, which will be further developed) is presented in the 1 figure below.



**Fig 1. The general appearance of the internal part of the physics mobile application.**

The approximate diagram of how to fill the internal part of the mobile application in physics. It should be created in Uzbek language since the program is dedicated to students and pupils of our republic. According to the scheme shown in the first figure above, each section is divided into smaller sections and elaborately prepared with information and its proper arrangement. Here, we only provided the general scheme.

**III. CREATING AND FILLING A MOBILE APPLICATION 'WITH INFORMATION, AS WELL AS IMPLEMENTING IT.** How is this proposed program created? Who creates it? Where is the information obtained? How and by whom is it financed? Let's address these and similar questions below. First, let's identify for whom this program is intended, namely: school students, college and lyceum students, university students, teachers of the secondary education system, professors, and individuals interested in scientific research in physics. Each of them can benefit from a specific part of this program, and the remaining part may not be essential for them. Therefore, it is necessary to create the content of this mobile program according to the needs of each target group. Now, let's answer the above questions one by one: the program is created by physics experts and developers, it can be created by any company or individual, information is obtained from textbooks, teaching aids, and the internet, financial expenses for creating the program are planned by the responsible ministry. After the program is created, the developer and creator sign an annual contract and are provided with a certain amount of money to ensure that the news and programmatic sections of the program are continuously updated.

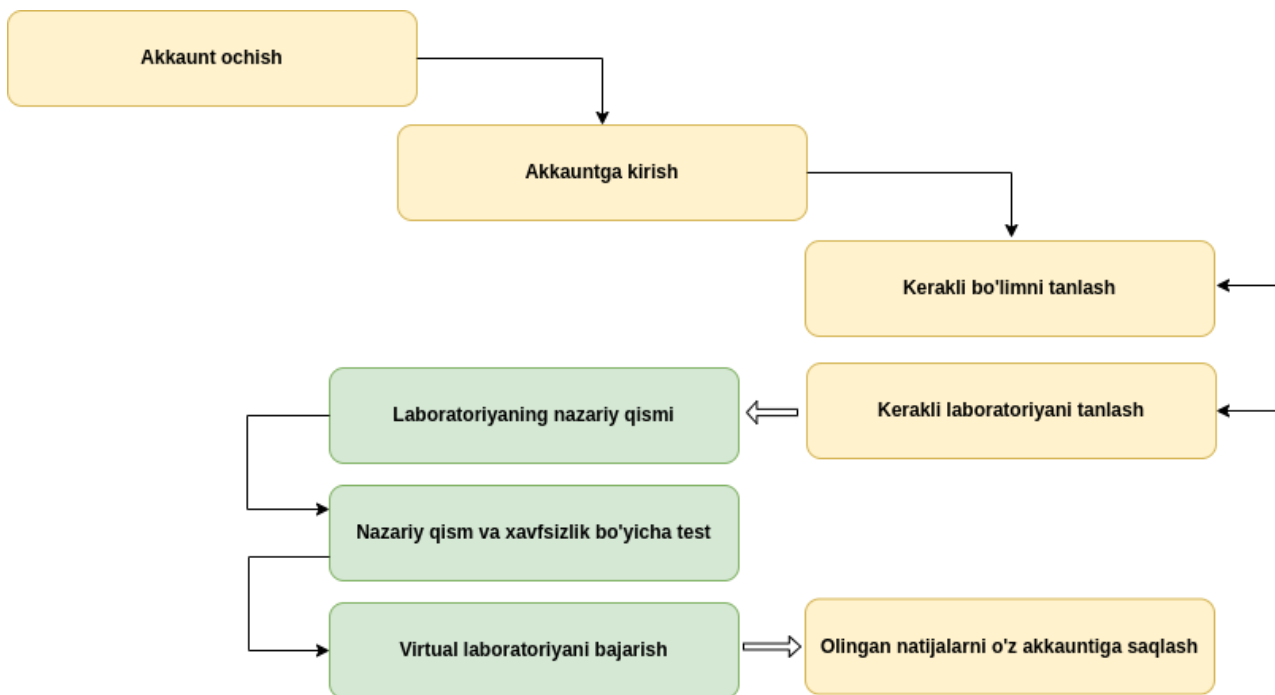
**IV. VIRTUAL LABORATORIES.**



**4.1. Creating virtual laboratories.** These days, the performance of computer models of physical phenomena, virtual physical experiments using computer programs or applications on smartphones in a simple way, without a personal computer, has a practical impact on the development of cognitive abilities, imagination and potential of students (Qorjobova M, 2023). Compared to conventional laboratories, virtual laboratories have several advantages. First, traditional laboratories are much more expensive and cause several inconveniences in their use. As an example, nuclear and neutron physics, the cost of the apparatus used in laboratories in atomic physics is expensive, and in the event of their failure, re-correction, or re-purchase, will cost the Secondary education much more. Secondly, in Secondary education, when using laboratory equipment brought to teach physics, students cannot see them directly using them. Due to fact that in the case of the high cost of laboratory equipment, on the other hand, some laboratory equipment is always in charge or under the supervision of a teacher, so students cannot do independently laboratory work. Because if the equipment breaks, a large amount of money is required again. This is what we can cite as an example several aspects of discomfort like this. Instead, it is advisable to use virtual laboratories in universities (even in the secondary education system). There are several advantages of Virtual laboratories, let is look at a few of them:

- Virtual laboratories can be used whenever you want, so much so that without stepping out of your comfort zone;
- The risk of breakdown, failure and similar aspects will disappear;
- There will be no effects that can affect to students (or students of Secondary Education) direct life (for example, when working with electrical equipment, studying radioactive radiation and etc.);
- The teacher will not be required to complete the laboratory and so on.

**4.2. Mobile application of virtual laboratories.** According to the ideas presented above, it can be said that creating virtual laboratories is convenient for everyone. Nowadays, many researchers and educational institutions are making a lot of progress in creating virtual laboratories (Zhang, 2021). The mobile application of this virtual laboratory that we are suggesting is convenient for everyone. The general scheme of this virtual laboratory can be as follows (see the second figure below).



**Fig 2. The general operating principle of the mobile application of virtual laboratory.**

Now we will explain how information is stored in each section. **To create an account** - a phone number, name, surname, school, lyceum, college, university name, and a username and password are entered and activated by an SMS code. **To log in to the account** - the username and password are used after the account has been activated. When logging in, the available sections are displayed: "School", "Lyceum", "College", "University", "Special Laboratories" list of topics, "Schematics and Information on Various Devices", "Technical Safety Information", "Error Correction", information on "Programs" and "Programming Languages" used in laboratories, and a list of various physics "Simulations" that the student (or pupil) can choose from. **To select a necessary laboratory** - when a laboratory is chosen, the following appear on the screen: 1) The theoretical part of the laboratory (purpose of the experiment, how it is carried out, formulas, and others) 2) Tests related to the theoretical part and technical safety (especially important in special laboratories!) 3) After completing the test, it is possible to proceed to a virtual laboratory. Finally, after the laboratory is completed, all of the above can be saved in a **.pdf** format on the account.

## V. CONCLUSIONS AND SUGGESTIONS

The article discusses the importance of developing online virtual laboratories and a mobile application to enhance the learning experience of secondary school students studying physics. It emphasizes that virtual laboratories and mobile applications can better help students understand complex scientific concepts and perform virtual experiments without the limitations of traditional laboratory settings. The proposed virtual laboratories and mobile applications should have a user-friendly interface, engaging multimedia content, and interactive features to promote self-directed learning and critical thinking skills. The article concludes that the implementation of online virtual laboratories and mobile applications will enable students to learn physics in a more accessible and engaging manner.



The suggestion is to design virtual laboratories and mobile applications that have a user-friendly interface, engaging multimedia content, and interactive features to promote self-directed learning and critical thinking skills. The proposed virtual laboratories and mobile applications should be implemented to enable students to learn physics in a more accessible and engaging manner. The article highlights the need for virtual laboratories and mobile applications as traditional educational methods struggle to keep up with the demands of modern students.

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