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TIBBIY AXBOROT TIZIMLARI VA TELETIBBIYOTNI O'RGATISH UCHUN OCHIQ KODLI DASTURIY TA'MINOT

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Annotasiya. Ochiq manbali dasturiy ta'minot va bulutli hisoblash tizimlari tibbiy axborot tizimlari va teletibbiyotni o'qitishni qanday qo'llab-quvvatlashi haqida munozara. GNUHealth-ni taklif qilingan model yordamida joylashtirish taqdimot maqsadlarida amalga oshirildi.

Kalit so'zlar: *tibbiy axborot tizimlari, bulutli hisoblash, o'qitish*

ПРОГРАММНОЕ ОБЕСПЕЧЕНИЕ С ОТКРЫТЫМ ИСХОДНЫМ КОДОМ ДЛЯ ОБУЧЕНИЯ МЕДИЦИНСКИМ ИНФОРМАЦИОННЫМ СИСТЕМАМ И ТЕЛЕМЕДИЦИНЕ

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Аннотация. Обсуждение того, как программное обеспечение с открытым исходным кодом и системы облачных вычислений могут помочь в обучении медицинским информационным системам и телемедицине. Развертывание GNUHealth с использованием предложенной модели было сделано для целей презентации.

Ключевые слова: *медицинские информационные системы, облачные вычисления, обучение.*

OPEN-SOURCE SOFTWARE FOR TEACHING MEDICAL INFORMATION SYSTEMS AND TELEMEDICINE

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Annotation. A discussion on how open-source software and cloud computing systems can support the teaching of medical information systems and telemedicine. A deployment of GNUHealth using the proposed model was done for the purposes of the presentation.

Keywords: *medical information systems, cloud computing, teaching*

Introduction. Teaching students about the possibilities and practice of medical information systems has technical barriers that were historically difficult to overcome. One of these is the lack of uniformity of these information and communication systems, which makes teaching them different than teaching Excel, for example. However, one of the most important ones is student access to industrial-power software. The reasons for this are many: the cost of such software, which can be prohibitive for universities, and the need for computational infrastructure in-site. This also impairs the teaching of telemedicine, since the use of a common information system is fundamental for the efficient usage of remotely-obtained data, registration of diagnostics and following of the patient.

The first problem, that of cost, can be overcome by using free or open-source software, of which there are several options, such as GNUHealth, which is versatile enough to serve as a base for many types of classes. But this doesn't solve the problem of deployment, since these software tend to be managed by non-profit organizations who do not offer a hosted solution.

However, nowadays many cloud computing platforms have free tiers for software. Usually, these tiers are not recommended for real-world usage, such as the management of a hospital or a clinic, but they are sufficient for usage in the classroom. The fact that they can be easily replicated means different institutions can share common code. The fact that they can be easily reset is convenient for erasing old data between semesters. Many platforms such as Heroku, Fly.io, Netlify, Cloudflare, AWS and Google Cloud can be suitable for such tests, the choice will depend the needs of the application in hand.

In the following, I will describe the procedure for the deployment of GNUHealth. GNU Health is a health and hospital information system with focus on public health and social medicine. It is used, for example, by the United Nations University. It is split in many modules, with functionality ranging from the management of electronic health records, account management, to laboratory information management system.

An example application of this concept using GNUHealth can be found at *https://github.com/guaraqe/gnuhealth-nix-docker*.

Usage in the classroom. The most important aspect of these software is how can it be used in when teaching. One of the advantages of students having direct access to software in the classroom is that both teaching and evaluation can be constructive. That is, one can teach students by building something together, and one can evaluate students by their capacity of building things. This is both useful, since it approaches the classroom to actual practice, making sure that the student understands how the fundamental concepts of these systems are put into practice, and also convenient, since evaluation can be less subjective. For example, one can build a middle-term of final exam by establishing some task, splitting it into achievable, concrete and observable sub-tasks, and attribute points to each of these.

As soon as the software is available for students, many possible class arrangements are possible. For example, students may either share a common account, which removes preparation overhead for classes, or have personal accounts that allows one to trace their actions, which is convenient for evaluations.

When one uses software that is modular, containing different parts that have different uses, one may base lectures around these parts. Each module has a utility, that is, it solves a problem. This problem should presented to the students, and the practice should show how the problem is solved. For example, in a class one may teach the usage of a personal medical history by focusing on the corresponding software module.

Deployment pattern. The most common software deployment pattern nowadays is the usage of Docker images. Docker images are self-contained computing units that contain the software that is to be run, as well as all its dependencies. They are popular because deployments are easy to reproduce – to create a new deployment, one can use the same base Docker image, with different configuration, and obtain a new running server. This is interesting in the context of education because that allows departments in different universities to share the same base software and deployment code, reducing the need for redundant work, while maintaining different deployments suitable for their needs.

There are different ways to create a Docker image containing the desired software. It can be done either manually, by running Docker commands, or using Dockerfiles that contain the commands that must be executed to generate the image in a more reproducible way. Both of these approaches depend on the environment where such commands are being run, the OS version of the user, and so on. To offer a higher degree of reproducibility, one can use Nix to define the dependencies of Docker images.

Therefore, the procedure that I propose, and that I used for GNUHealth, is:

1. Package GNUHealth using Nix for reproducible building.
2. Build a Docker image using the dependency closure of the software.
3. Deploy this Docker image to the cloud platform using the suitable database configuration.

Procedure details. In this section I will give more details on what each one of these steps imply.

The first step is packaging GNUHealth using Nix. Nix is a package manager that offers complete build reproducibility for software packages. In order to obtain such reproducibility, one must define explicitly what are the dependencies of the software that is being packages. While most modern programming languages have lockfiles that make this work simpler, this is still a work-intensive activity for many packages. For example, for GNUHealth, it took me around 12 hours. However, when the work is done, it is guaranteed to be reproducible, and updates are simpler to manage, since one only needs to verify the software's changelog to determine whether dependencies changes are needed.

In this packaging step, it is important to make available for users the configurations that will be needed so that different deployments can be done using the same package. For example, one shouldn't hardcode the address of the database, since this would make the package not useful for other people. However, this can be done progressively, as the need for flexibility arises.

The second step is building the Docker image. In most setups this would imply determining the steps needed for the building the software in a way that is appropriate for Docker. However, using Nix, this is trivial (REF) and is defined by a file with a few dozen lines. Once more, most configuration should be available at this step, so that users can just change one command to satisfy their deployment needs.

Finally, one needs to deploy this Docker image. For this, one needs an account at the cloud computing platform and name the app. This will determine the address that will be used by students and staff to access the software, so it is a good idea to prepend it with the name of the institute. For example *tdsi-gnuhealth* is both explicit and easy to remember.

Conclusion. Modern cloud computing and open-source make server-based software more accessible to regular users, without the need for expensive infrastructure. As teachers, we can take advantage of this to make classes more participative and show students what is possible with modern technology.

References

1. *Luis Falcón*, GNUHealth, https://www.gnuhealth.org/
2. *Eelco Dolstra*, Nix, https://nixos.org/
3. *Docker Inc*, Docker, https://www.docker.com/
4. Абдуганиева, Шахиста Ходжиевна, Феруза Бахтияровна Нурматова, and Рахимжан Абдуллаевич Джаббаров. "Роль биомедицинской и клинической информатики в изучении медицинских проблем." *European Conference on Innovations in Technical and Natural Sciences*. 2017.
5. Нурматова, Феруза Бахтияровна. "Междисциплинарная интеграция биофизики в медицинском вузе." *Методы науки* 4 (2017): 78-79
6. Kh, Rakhimova. "Zh., Nurmatova FB The main physico-chemical properties of dental materials/Kh. Zh. Rakhimova, FB Nurmatova." (2018): 79
7. Абдуганиева, Шахиста Ходжиевна, and Феруза Бахтияровна Нурматова. "Прогнозирование атмосферного давления воздуха на город Антананариву на основе учета перераспределения гравитационных сил солнечной системы." *The priorities of the world science: experiments and scientific debate*. 2018
8. Абдуганиева, Ш. Х., and М. Л. Никонорова. "Цифровые решения в медицине." *Крымский журнал экспериментальной и клинической медицины* 12.2 (2022): 73-85
9. Абдуганиева, Ш. Х., and Л. А. Фазилова. "Мобильные учебные приложения: плюсы и минусы." *П24 Педагогика и психология в медицине: проблемы, инновации, достижения. Под редакцией д. м. н., профессора Ванчаковой НП—М. Издательство Перо, 2021.—* (2021): 7

10. Абдуганиева, Ш. Х., and Д. Исанова. "Изучение медицинских информационных систем на примере систем стандартизации" *ББК 1 А28* (2019): 23
11. Абдуганиева, Ш. Х. "Динамическая визуализация образования и развития белых кровяных клеток." *XVI-ая конференция,*

http://www.mce.biophys.msu.ru/rus/archive/abstracts/sect22319/doc32130/

12. Абдуганиева, Ш. Х. "Некоторые аспекты преподавания математических наук в медицинском высшем образовании." *Ответственный редактор–проректор по учебной работе ФГБОУ ВО ОрГМУ Минздрава России д. м. н., профессор ТВ Чернышева* (2021): 271
13. Абдуганиева, Шахиста Ходжиевна, and Феруза Бахтияровна Нурматова. "Биомедицинская информатика." *Теоретические и практические проблемы развития современной науки*. 2017
14. Абдуганиева, Шахиста Ходжиевна, and Рахимжан Абдуллаевич Джаббаров. "Математическое моделирование в решении медицинских задач. " *Научный прогресс* 3 (2017): 125-126
15. Абдуганиева, Шахиста Ходжиевна. "Цифровизация образования–путь к оптимизации преподавания: Абдуганиева Шахиста Ходжиевна, ТГСИ, кафедра биофизики и информационных технологий в медицине, старший преподаватель e-mail: Abduganieva72@ mail. ru." *Научно-практическая конференция*. 2022
16. Назарова Н. Ш., Жуматов У. Ж., Касимов М. М. Состояние местной иммунологической реактивности полости рта у работающих в табаководческой промышленности //Журнал теоретической и клинической медицины. – 2014. – №. 4. – С. 18-20.
17. Abduganieva, Shaxista, and Lutfinisa Fazilova. "The use of asymmetry and excess estimates to verify the results of medical observations on indicators for normality." *Asian Journal of Multidimensional Research (AJMR)* 10.1 (2021): 79-83
18. Нурматова, Ф. Б., and А. Н. Кобзарь. "Специфика обучения биофизике будущих стоматологов (из опыта работы российского и узбекского медицинских вузов)." *Педагогическое образование и наука* 3 (2020): 122-127
19. Кобзарь, Антонина Николаевна, and Феруза Бахтияровна Нурматова. "ИЗ ОПЫТА ПРЕПОДАВАНИЯ БИОФИЗИКИ В МЕДИЦИНСКИХ ВУЗАХ (НА ПРИМЕРЕ РОССИИ И УЗБЕКИСТАНА)." *Актуальные проблемы образовательного процесса в высшей медицинской школе: от теории к практике*. 2019
20. Нурматова, Ф. Б. "Методические подходы к преподаванию биофизики в стоматологическом вузе." (2019): 198-203

21. Рахмонова, М. С., Ф. Б. Нурматова, and Р. Т. Муминов. "Использование музыкальной терапии при лечении больных в стоматологии." (2019): 233-237
22. Рахимова, Х., and Ф. Нурматова. "Основные физико-химические свойства стоматологических материалов." Stomatologiya 1.2 (71) (2018): 83-85
23. Рахимова, Х., and Ф. Нурматова. "Физические основы рефлексотерапии. Определение электроактивных точек на кожной поверхности." *Stomatologiya* 1.4 (73) (2018): 85-86
24. Рахимова, Хакима Джураевна, and Феруза Бахтияровна Нурматова. "Лечение воспалительных процессов слизистой оболочки полости рта переменным магнитным полем." *Высшая школа* 6 (2017): 84-85
25. Нурматова, Феруза Бахтияровна. "Электронный учебник как средство мультимедийного обучения: Нурматова Феруза Бахтияровна, ТГСИ, кафедра биофизики и информационных технологий в медицине, заведующая кафедрой feruzanurmatova_tdsi@ mail. ru." *Научно-практическая конференция*. 2022
26. Bakhtiyarovna, Nurmatova Feruza. "Organization and Methodology Laboratory Works on Biophysics for Dental Direction." *Annals of the Romanian Society for Cell Biology* (2021): 597-607
27. Bakhtiyarovna, Nurmatova Feruza. "Organization and Methodology Laboratory Works on Biophysics for Dental Direction." *Annals of the Romanian Society for Cell Biology* (2021): 597-607
28. Рахимова, Х., and Ф. Нурматова. "Стоматологик материалларнинг физик хоссаларини текширишда қўлланиладиган технологик усуллар." *Stomatologiya* 1.4 (65) (2016): 121-126
29. Юлдашев, С. Д., et al. "Стимуляция роста почечных телец в динамике постнаталь-ного развития." *Морфология* 133.2 (2008): 159а-159а
30. Нурматова Феруза Бахтияровна, Нигора Эргашевна Махкамова, and Улугбек Нуридинович Вохидов. "Интегративный подход к преподаванию биофизики в медицинском вузе на примере раздела" БИОАКУСТИКА." Молодой ученый Учредители: ООО" Издательство Молодой ученый" 12: 261-264
31. Zukhriddinovna, Khodjaeva Diyora. "Methodology of teaching physics in academic lyceums of medical direction." *Journal of Critical Reviews* 6.5 (2020): 2019
32. Zuhriddinovna, Khodjayeva Diyora. "Professional teaching of physics in academic lyceums in medical direction." *ACADEMICIA: An International Multidisciplinary Research Journal* 10.5 (2020): 837-840
33. Khodjaeva, D. Z., N. S. Abidova, and A. M. Gadaev. "Providing correct evaluation of students in distance learning." *polish science journal* (2021): 52

34. Khodjaeva, D. Z., B. I. Haydarova, and M. Z. Atajiyeva. "The importance of unification of sciences in higher education institutions and academic lyceums." *polish science journal* (2021): 55
35. Ходжаева, Д. З. "Предмет физики-как профессионально-ориентировочное средство в формировании профессиональной деятельности врача." *Magyar Tudományos Journal* 38 (2020): 46-49

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TIBBIY-BIOLOGIK FANLARINI O'RGANISHDA ZAMONAVIY YONDASHISH.

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Аннотация: XXI asr axborot texnologiyalari va innovatsiyalar asri. Ilm-fan va xalq xo'jaligining barcha sohalarida eng yangi texnologiyalardan keng foydalanilmoqda. Zamonaviy ta'lim, jumladan, oliy ta'lim ham bundan mustasno emas. Bu axborot texnologiyalarini to'liq qo'llashni talab qiladi. Zamonaviy tibbiyot bugungi kunda zamon bilan hamnafas bo'lib, diagnostika va davolash sohasida ham, kadrlar tayyorlashda ham eng yangi axborot texnologiyalaridan keng foydalanmoqda. Har bir mutaxassis o'z sohasining professionali bo'lgani uchun kompyuter texnologiyalaridan foydalanish ko'nikmalarini mukammal egallashi, amaliy va maxsus dasturlarni o'z faoliyatida to'g'ri va o'rinli qo'llay bilishi kerak. Bu esa, tibbiy ta'limda kompyuterlardan keng foydalanishni taqozo etadi.

Kalit so'zlar: oliy ta'lim, zamonaviy tibbiyot, kompyuter dasturlari, internet resurslari, Pirogov jadvali, 3D portlar.

СОВРЕМЕННЫЙ ПОДХОД К ИЗУЧЕНИЮ МЕДИКО-БИОЛОГИЧЕСКИХ НАУК

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Аннотация: XXI век – век информационных технологий и инноваций. Во всех отраслях науки и народного хозяйства широко применяются новейшие технологии. Современное образование, в том числе и высшее образование не исключение. Оно требует полного применения информационных технологий. Современная медицина, сегодня шагая со временем в ногу, широко применяет новейшие информационные технологии как в сфере диагностики и лечения, так и в подготовке кадров.