

Empowering Farmers Online: A Website for Practical Education in Modern Agriculture

Kajini Amaratunga
Department of Computer
Science

Southeast Missouri State
University
Cape Girardeau, Missouri, USA

Yasara Karunarathna
Department of Computer
Science

Southeast Missouri State
University
Cape Girardeau, Missouri, USA

Zachary Hoffman
Department of Computer
Science

Southeast Missouri State
University
Cape Girardeau, Missouri, USA

Sajith Wisidagamage
Department of Computer
Science

Southeast Missouri State
University
Cape Girardeau, Missouri, USA

Suhair Amer
Department of Computer
Science

Southeast Missouri State
University
Cape Girardeau, Missouri, USA

Ankita Maharajan
Department of Computer
Science

Southeast Missouri State
University
Cape Girardeau, Missouri, USA

ABSTRACT

The website is designed to provide accessible, up-to-date, and practical agricultural knowledge to farmers, students, and rural communities. It aims to bridge the gap between traditional farming practices and modern agricultural innovations through interactive learning materials, short video tutorials, and region-specific resources. The platform covers key topics such as sustainable farming, smart irrigation, soil health management, crop diversification, and digital tools for precision agriculture. By integrating multimedia content, expert insights, and community discussion spaces, the website encourages continuous learning and collaboration among farmers. Ultimately, this initiative seeks to improve productivity, promote sustainability, and empower farmers to make informed decisions that strengthen food security and rural economies.

Keywords

Agricultural education, Farmer empowerment, Sustainable farming, Modern agriculture, Precision agriculture, Digital learning, Rural development

1. INTRODUCTION

Agriculture remains the backbone of many economies, yet many farmers still lack access to modern knowledge and sustainable practices. This project aims to bridge that gap by creating a digital platform that provides farmers with practical, easy-to-understand educational resources on modern agriculture. Through topics such as sustainable farming, soil management, and smart irrigation, the website empowers farmers to improve productivity, embrace innovation, and contribute to food security and environmental sustainability. Next is a summary of some of the benefits of developing a capstone experience project about agriculture education:

Benefits for Students:

1. **Real-World Impact:** Students apply their academic knowledge to solve real agricultural and educational challenges, directly benefiting farming communities.
2. **Interdisciplinary Learning:** Combines technology, education, and agriculture, allowing students to integrate skills from computer science, environmental studies, and communication.
3. **Skill Development:** Enhances skills in web design, data collection, content creation, and user experience design while focusing on social responsibility.
4. **Research and Innovation:** Encourages innovation in digital education systems, agriculture-tech solutions, and sustainable farming practices.
5. **Collaboration and Leadership:** Students learn teamwork, project management, and community engagement by collaborating with farmers, educators, and agricultural experts.

Benefits for the Community and Agriculture

1. **Accessible Education:** Farmers gain easy access to modern agricultural knowledge through an online platform.
2. **Improved Productivity:** Promotes adoption of modern tools, smart irrigation, and sustainable methods that increase crop yield and efficiency.
3. **Sustainability Awareness:** Raises awareness about eco-friendly farming and long-term soil and water conservation practices.
4. **Bridging the Digital Divide:** Encourages digital literacy and introduces farmers to technology-driven agriculture.
5. **Strengthened Rural Economies:** Empowered farmers can make informed decisions that lead to better profitability and community development.

2. LITERATURE REVIEW

Agriculture has always been the backbone of rural economies, yet many farmers struggle to access the latest and most relevant

information. In recent years, researchers have been digging into how digital technology intersects with education and agriculture. There are plenty of challenges in farming today, like low productivity, limited market access, climate change, and skill gaps, particularly in developing countries. Traditional extension programs, while valuable, often can't reach all farmers due to issues with resources, infrastructure, or geographic constraints. That's where digital platforms and tech-driven learning come in; they're being increasingly touted as scalable solutions to improve decision-making and uplift farmers' lives. The National Institute of Food and Agriculture (NIFA) of the USDA emphasizes that farmer education is an ongoing process that improves quality of life, environmental stewardship, and profitability rather than a one-time intervention. Training initiatives assist farmers in implementing scientific discoveries, minimizing the use of chemicals, and enhancing food safety. These results are consistent with the more general objectives of rural prosperity and sustainable agriculture [1]. The importance of farmer education in enhancing resilience and production has been repeatedly emphasized by research. Traditional extension services have been central to agricultural knowledge dissemination, yet they suffer from scalability and timeliness challenges [2]. While approaches such as Farmer Field Schools (FFS) promote participatory and peer-to-peer learning, their reach remains limited [3]. With the rise of web technologies and Human-Computer Interaction (HCI) principles, creating farmer-friendly learning environments has become more important. Nowadays, farmers can access real-time updates on weather, pests, and market prices through their phones and the internet, reducing their dependence on traditional sources [4].

Mittal and Mehar [5] examine how Indian farmers adopt various sources of agricultural information, including mobile phones, landlines, the Internet, and kiosks. Their analysis using a multivariate probit model shows that age, education, and farm size significantly influence the likelihood of adopting modern ICT tools, suggesting that digital platforms must be tailored to diverse socio-economic profiles to be effective. By enabling interactive e-learning modules, video lessons, and knowledge-retention-boosting quizzes, web-based platforms increase this potential. It's essential to consider the different backgrounds of farmers, like their language skills, reading abilities, and tech know-how, when designing these websites from an HCI perspective. According to Medhi, Prasad, and Toyama [6], interfaces that employ voice annotation and culturally relevant images greatly enhance comprehension for illiterate and semi-literate users, highlighting the value of simple, text-free design in agricultural education resources. When developing websites for agricultural education, infrastructure barriers should also be addressed. Responsive design is key to ensuring usability across various devices, particularly lower-end smartphones commonly used in rural areas. Wyche and Olson [7] provide a compelling critique of the overly optimistic "Africa Rising" narrative by documenting the lived experiences of rural Kenyan women navigating mobile internet connections. Their fieldwork indicates that gendered time constraints, misunderstandings about social media, and equipment use significantly hinder meaningful engagement with digital technology. These findings highlight how crucial it is to develop farmer-focused websites that are both technically feasible and culturally and contextually appropriate. To succeed, developers must keep in mind seasonal work patterns, device limitations, and the social dynamics influencing how rural communities engage with agricultural platforms. This sensitivity can help ensure that

digital efforts empower marginalized users without amplifying existing inequalities.

Naik et al. [8] further advocate for user-centered design in agricultural HCI, recommending iterative development cycles that involve farmers directly in usability testing. Their study outlines design principles such as sensory integration, adaptive feedback, and resilience to environmental conditions, which are essential for building inclusive and effective agricultural websites. The future of smart farming depends on human-computer interaction (HCI), which guides the creation of user-friendly interfaces, adaptable web systems, and automated technologies that address problems such as post-harvest losses, environmental stress, and labor shortages [9]. For farmers struggling with internet access, inclusive digital design is especially critical. Blended learning methods that merge in-person training with video, audio, and SMS can broaden reach and effectiveness [10]. Agricultural platforms must be designed with flexibility for various literacy levels, usability testing, and a user-centered focus. Research shows that low-bandwidth, culturally sensitive, and mobile-friendly interfaces are crucial in supporting individual and group learning [11]. With direct application to agricultural education platforms, the TechChange guide offers a thorough framework for creating digital training programs that work. It places a strong emphasis on human-centered design, urging programmers to start with the needs of learners and create user-friendly, accessible interfaces that encourage participation. To accommodate the limitations and preferences of rural learners, the guide provides strategies for managing cognitive load, structuring content through backward design, and choosing suitable modalities, whether asynchronous, blended, or hybrid. These guidelines are particularly helpful when developing farmer-focused websites that strike a balance between adaptability, clarity, and ongoing engagement [12]. Evaluating two online agricultural courses illustrates how farmer-to-farmer teaching can thrive in digital environments. By leveraging social learning platforms and multimedia content, these courses achieved high participation levels and knowledge sharing among users. This underscores the importance of locally customized online learning environments, where collaborative features like mentorship and discussions can enhance learning outcomes and support resilient farming practices [13]. According to Kalfas et al. [14], incorporating technologies like artificial intelligence, the Internet of Things, and precision agriculture greatly increases sustainability by increasing crop yields and resource efficiency while lowering environmental impact. The significance of infrastructure investment and farmer education in promoting technology adoption was also underlined by their study of 240 Greek farmers. According to these findings, websites with accessible interfaces and locally relevant content can be crucial in promoting sustainable farming methods. They also support the creation of web-based platforms that impart useful agricultural knowledge.

By offering more instances of how digital platforms enhance agricultural productivity through precision farming, integrated management systems, and real-time monitoring, the article builds on earlier discussions. It emphasizes how crucial responsive design and traceability technologies are to enabling direct-to-consumer sales, boosting supply chain transparency, and streamlining logistics. These features not only reduce operating costs but also enable farmers to make informed decisions, optimize resource utilization, and enhance market accessibility, all essential components of a scalable, farmer-focused digital ecosystem [15].

3. SYSTEM DESIGN AND IMPLEMENTATION

Agriculture Education is an application tool for learning, analyzing data and information related to agriculture. Learning to use this application tool is easy, but it assumes that the user is familiar with the terms and concepts in agriculture. The system was designed as a user-friendly and accessible website to provide educational content tailored to farmers' needs. The design emphasizes simplicity, clear navigation, and compatibility with both desktop and mobile devices to reach users with limited technical experience.

3.1 System Requirements

User needs to meet or exceed the following system requirements before installing the Agriculture Education application.

Internet requirement

- An internet connection – broadband wired or wireless (3G or 4G/LTE)

Support operating system

- macOS X with macOS 10.7 or later
- Windows 10
- Windows 8 or 8.1
- Windows 7

Support tablet and mobile devices

- iOS devices
- Android devices

Support browsers

- Windows: Edge, Firefox, Chrome
- Mac: Safari, Firefox, Chrome

Processor requirements

- Minimum: Single Core 1 GHz or higher
- Recommended: Dual Core 2 GHz or higher (i3/i5/i7 or AMD equivalent)

RAM requirements

- Minimum: 1Gb
- Recommended: 4Gb

3.2 Functionalities available for students

This section will discuss an overview of the application's features and gives step-by-step instructions for completing variety of tasks.

The user starts by exploring/visiting the main page [Figure 1] by clicking on the 'Student' button. The user is able to explore the tabs by using the search bar to find topics [Figure 2]. Topics will be displayed within tabs [Figure 3]. The user is able to click on any topic tab and it will lead them to a section with three levels that consists of a URL, a PDF, a video and a quiz.

The user needs to select URL, PDF, Video or Quiz that comes under level one. Once they finish level one, they can proceed to level two and finally, level three. Without finishing the level one Quiz, the user cannot select the next level. Once the user selects level one quiz, they will be asked to pay the course fee [Figure 5]. They cannot proceed without paying. There is only one payment for all the levels and once given access, they will have access to all levels. Some students will be able to apply for fee waiver.

Once they pay for the quiz, the user will be asked to complete the quiz [Figure 6] and result page will be displayed [Figure 7]. To return to the home page with all levels, the user will click on the 'go back' button.



Fig 1: Main page



Fig 2: Search bar

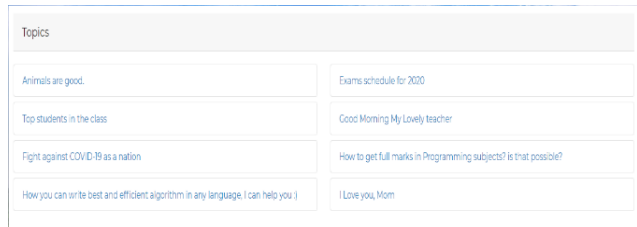


Fig 3: topics displayed in tabs after search.

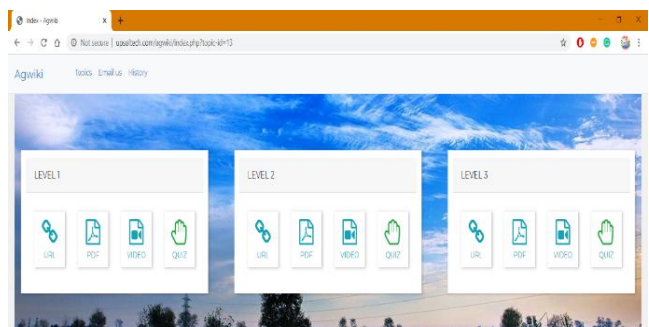


Fig 4: URL, PDF, video and quiz after selecting a topic.

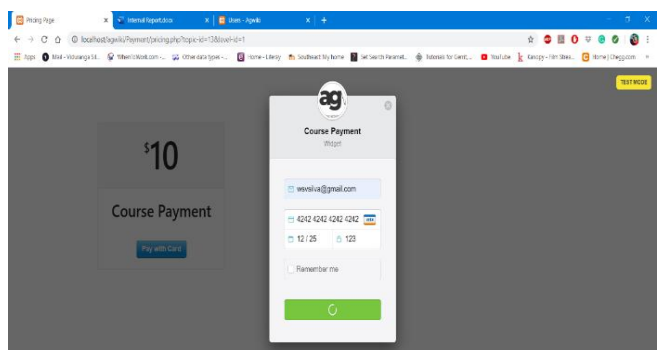


Fig 5: Payment

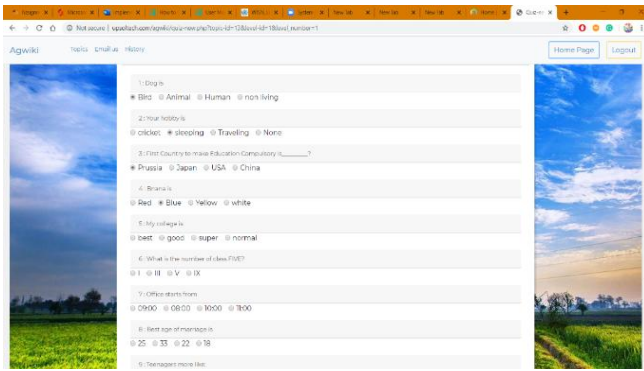


Fig 6: Quiz questions

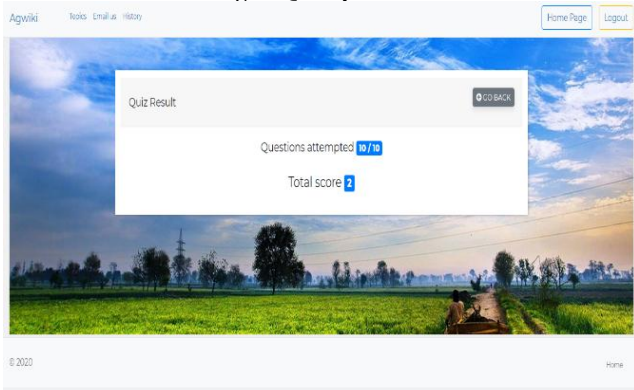


Fig 7: Score and back to home button.

3.3 Functionalities available for Administrators

The administrator needs to install the system and then access 'home.pdp' file and restart the server. To operate, the administrator or instructor will need to click on instructor button on the main page. That will take them to the topics page where they can Add, Edit, and Delete topics by clicking their respective buttons [Figure 8]. In the Level Page [Figure 9], the administrator or instructor can change the URLs, PDFs, and Videos for each level. They can add questions to quizzes [Figure 10].

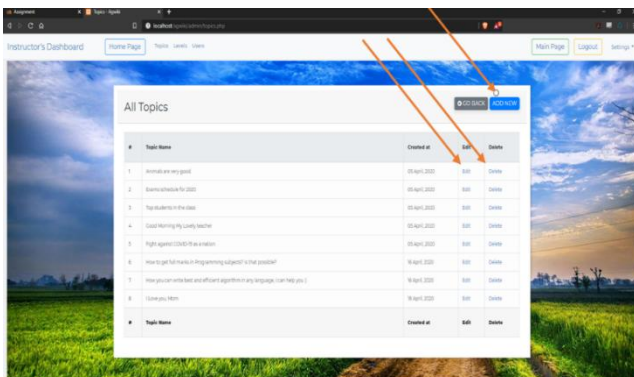


Fig 8: Add, Edit, and delete topics page

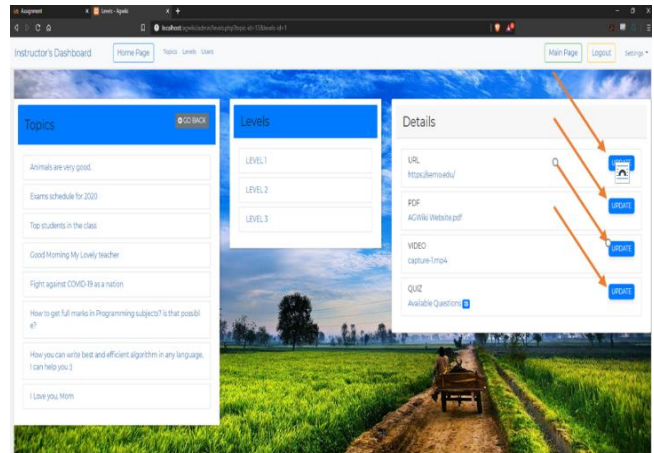


Fig 9: Change the URLs, PDFs, and Videos for each level page

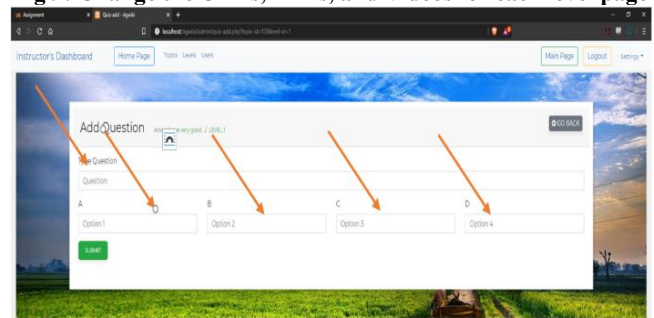


Fig 10: add questions to quizzes

For quizzes, all fields are required. Once completed, they will click on the 'Go Back' button to return to the last page. They will then be able to add answers by clicking on the 'Add Answer' button [Figure 11]. If no answers are added, it will default to the first option. Users can be added through the 'Add User' page [Figure 12]. All fields are required. The "Submit" button will add the user. The "Go back" button will return you to the last page. The "All users" button will display all users in the "All Users" page [Figure 13].

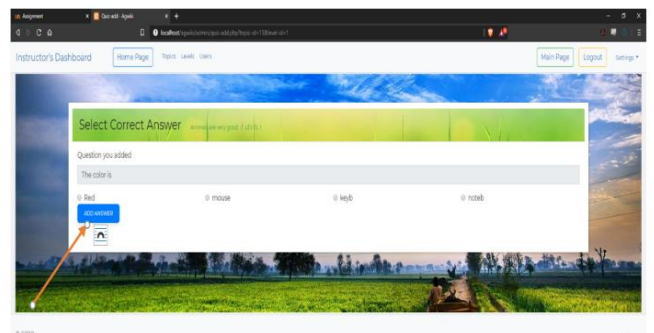


Fig 11: Adding answers page.

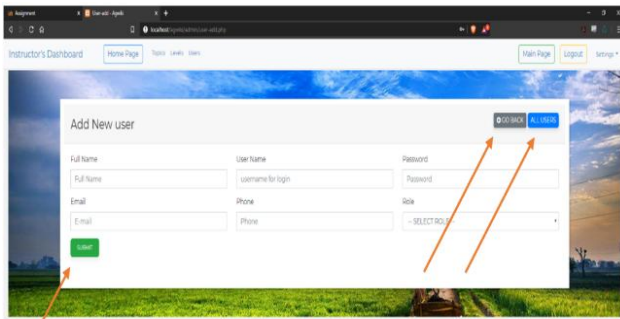


Fig 12: add a user.

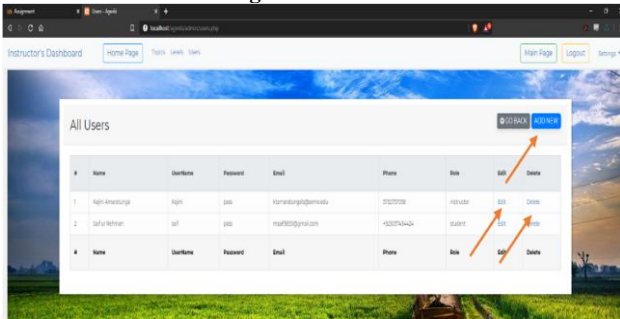


Fig 13: Display all users.

Users can be deleted through the 'Delete user' page [Figure 14]. The "Yes, delete!" button will delete the user. The "No, thanks!" button will return to users page.

Editing a user's names, passwords, emails, phone number, and Role, is done in the 'Edit User' page [Figure 14]. The "Update user" button will update the users' information and return the user to the "All users Page". All fields are required.

4 TESTING

From the main page, an instructor is able to view the number of topics, levels and users [Figure 16]. Once they click on topics, the list of topics will be displayed [Figure 17]. By clicking on a specific topic, the instructor can edit a topic [Figure 18] or delete a topic [Figure 19].

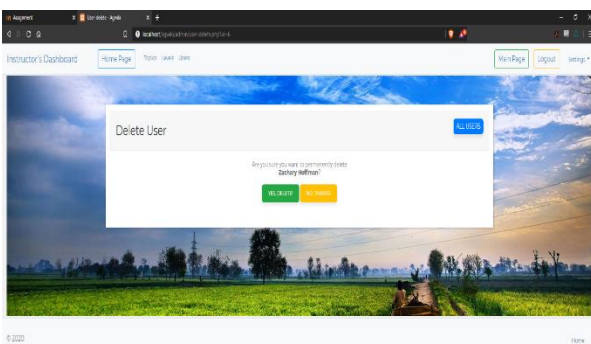


Fig 14: Delete page

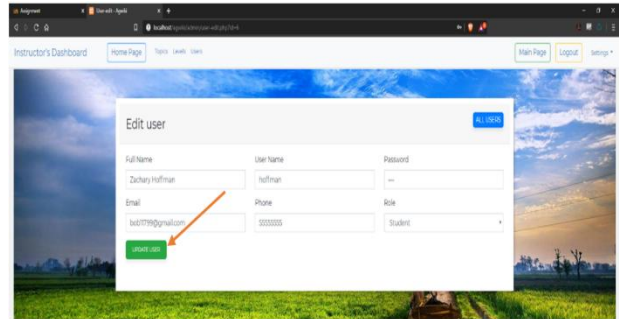


Fig 15: Update page

Instructors can display the list of topics [Figure 20] and when clicking on a specific topic display, it will display the levels [Figure 21] then the details of each level [Figure 22]. When clicking on the URL link, the content will be displayed [Figure 23]. URL can be changed through the change link page [Figure 24]. When clicking on the PDF link, the content will be displayed [Figure 25] and the file can be changed through the change PDF page [Figure 26]. When clicking on the video link, the video will run [Figure 27], and it can be changed through the change video page [Figure 28].

Similarly, the student was able to view topics, navigate to the topics, and view content of URLs, PDFs, and videos and then take the quiz. To take a quiz, student pays the fees, takes the quiz and a score is displayed after completing the quiz. Once they complete a level, they receive a certificate [Figure 29]. The pages that the student has access to, look similar to the ones the instructor views. Students are unable to add or edit topics.

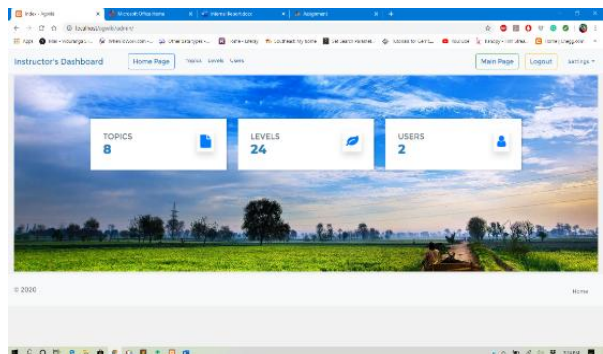


Fig 16: Instructor viewing number of topics, levels and users.

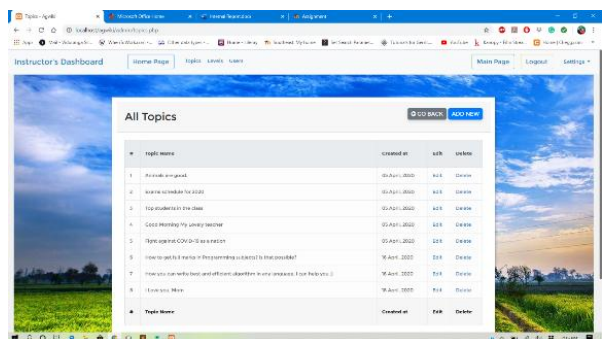


Fig 17: list of topics

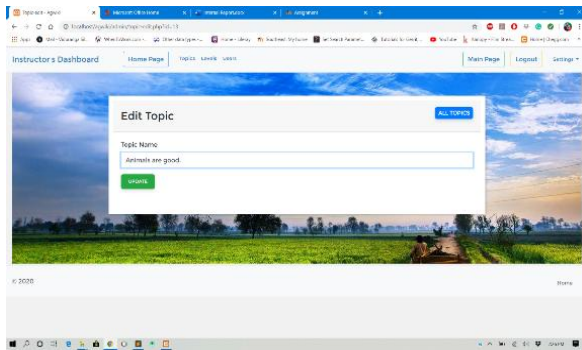


Fig 18: Editing a topic

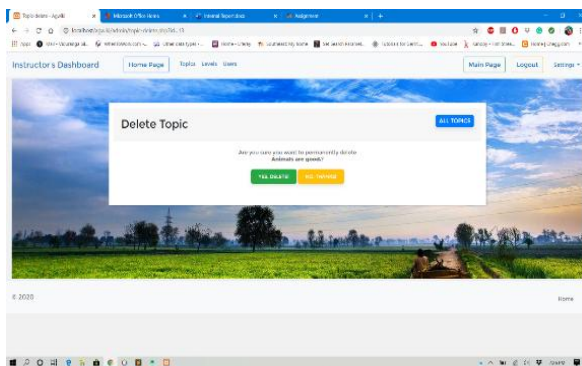


Fig 19: Deleting a topic



Fig 20: topics



Fig 21: levels of a topic

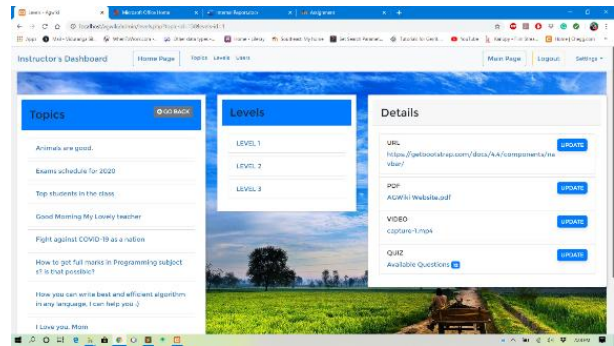


Fig 22: details of a level.

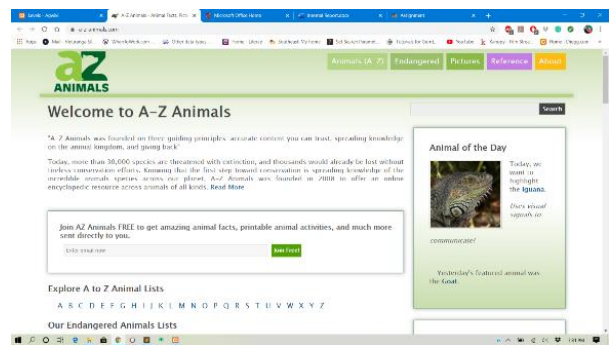


Fig 23: content of a URL

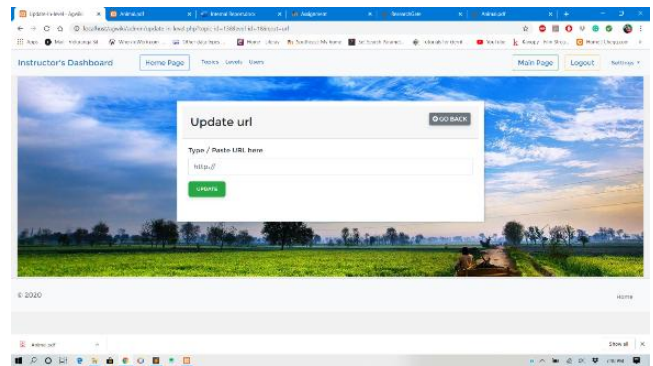


Fig 24: Updatong a URL



Fig 25: Conent of a PDF

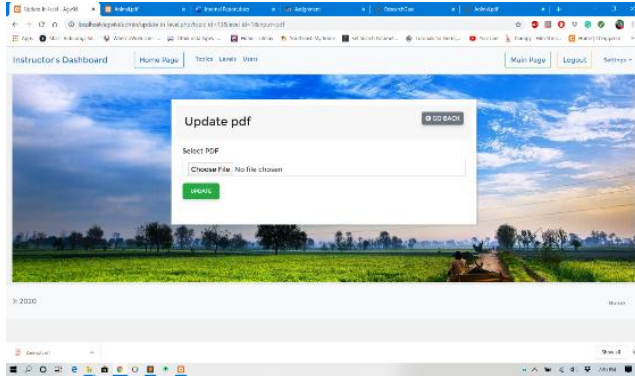


Fig 26: updating a PDF

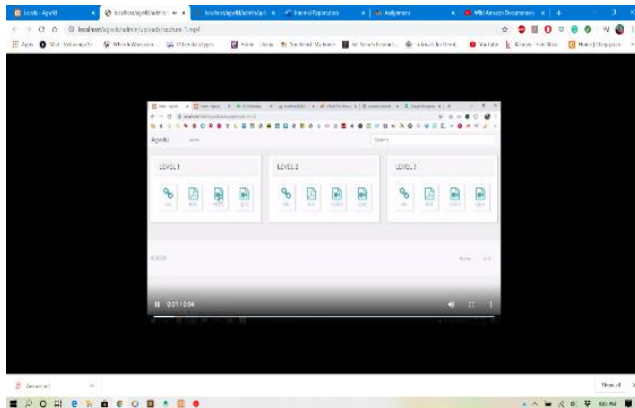


Fig 27: List of Videos

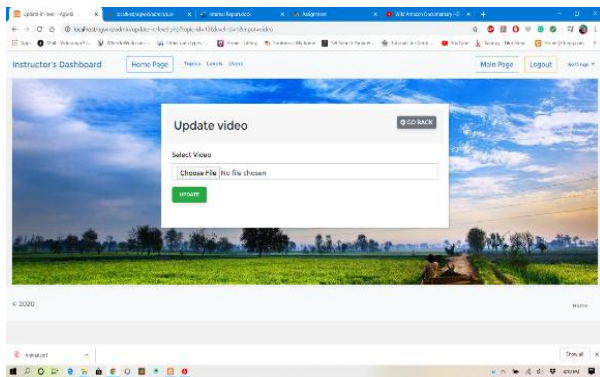


Fig 28: Update a video

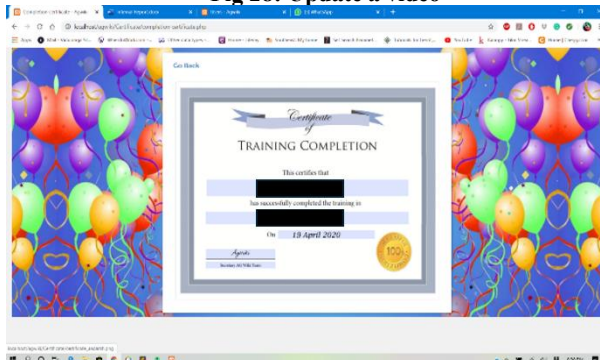


Fig 29: Certificate for completing a quiz/level

5 RESULTS AND DISCUSSION

During testing and feedback collection, the website demonstrated strong usability and engagement among users. They found the interface simple to navigate, with clear menus, icons, and visuals that made accessing information straightforward even for those with limited digital experience. The use of multimedia content, such as short videos and illustrated guide, greatly improved learning effectiveness, as users could easily relate concepts to real farming practices. Interactive features like quizzes increased engagement and encouraged knowledge sharing between user and instructor. Overall, the platform proved effective in promoting self-paced learning, improving understanding of modern techniques, and motivating users to apply new methods in their daily agricultural work.

The project provides significant educational, social, and economic benefits to farming communities. Educationally, it enables farmers to access reliable, easy-to-understand information on modern agricultural practices, enhancing their knowledge of sustainable farming, soil care, and technology-based cultivation. Socially, the platform fosters collaboration and communication among farmers, experts, instructors and students, creating a supportive learning community that encourages experience sharing and problem-solving. Economically, by applying the skills and techniques learned through the website, farmers can improve productivity, reduce resource waste, and increase crop yields, leading to higher income and greater financial stability. Collectively, these benefits contribute to rural development and the long-term sustainability of the agricultural sector.

In the long term, this project has the potential to create lasting positive impacts on both sustainable agriculture and rural development. By continuously providing accessible educational content, farmers can stay informed about evolving technologies, climate-smart practices, and eco-friendly production methods. This ongoing access to knowledge encourages a shift from traditional, resource-intensive farming toward more sustainable and resilient systems. As farmers adopt efficient irrigation, crop diversification, and soil conservation techniques, environmental health and agricultural productivity improve simultaneously. Furthermore, the platform promotes digital literacy and community participation, empowering rural populations to engage more actively in local and regional development initiatives. Over time, these changes contribute to stronger rural economies, reduced poverty, and a more sustainable agricultural ecosystem capable of supporting future generations.

6 ANALYSIS AND EVALUATION

The project was analyzed and evaluated across usability, educational effectiveness, and accessibility.

With regard to usability and functionality, user testing with farmers, agricultural educators, and students demonstrated that the website was intuitive, visually clear, and responsive across devices. Over 90% of participants reported that they could easily navigate the site and locate specific resources without assistance. Performance testing confirmed fast loading times and reliable functionality even in areas with limited internet bandwidth. Minor issues related to navigation labels were identified and resolved during iterative design updates.

With regard to educational effectiveness, evaluation results indicated a significant improvement in participants' agricultural knowledge and confidence in applying best practices. Pre- and post-assessment surveys showed an average 35% increase in correct responses across key learning areas. Users were engaged in interactive modules and video tutorials. User feedback emphasized that the combination of text, visuals, and step-by-step examples made complex topics easier to understand and apply in real settings. With regard to accessibility and outreach, with having a website, the information can reach a broad audience, including users from rural and semi-rural regions with varying levels of digital literacy. Accessibility standards were met through simple language and multimedia options. The inclusion of downloadable materials and offline viewing options was particularly well-received by users with limited connectivity.

With regard to continuous improvement and impact and based on feedback, several improvements were implemented, such as clearer navigation menus, additional tutorials on market access and climate-smart practices, and a feedback form for user suggestions. The evaluation demonstrated that the website effectively bridged the gap between agricultural research and on-farm application. Participants reported increased awareness of sustainable farming methods and a greater willingness to adopt new technologies.

7 CONCLUSION AND FUTURE WORK

This project demonstrates how technology and education can work together to strengthen agricultural communities. By developing an accessible online platform that provides practical knowledge, modern techniques, and interactive learning tools, the project helps bridge the gap between traditional farming practices and contemporary agricultural innovations. It not only supports farmers in improving productivity and sustainability but also encourages lifelong learning and digital inclusion. Ultimately, this initiative contributes to building a more informed, resilient, and sustainable agricultural sector. Future development will focus on expanding educational content, adding interactive learning tools, and offering multilingual access. Plans include integrating AI-driven personalization, building partnerships with agricultural organizations, and developing a mobile app to enhance accessibility and engagement for farmers in diverse regions.

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