Learning Management System for Programming Languages

Software Requirements Document

CSCE 247 Software Engineering

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1. Introduction

According to the US Bureau of Labor Statistics, the employment of software developers, software quality assurance analysts, and software testers is set to grow by 25% in the next decade. Comparing this growth to the 5% average reveals the need for an effective way to teach programming. However, many people struggle to learn how to program. Whether it be differing syntax, different structures within each language, or different data types, learning a new language can seem like a daunting task. Our project is to develop a learning management system (LMS) for people to easily learn new programming languages. It will have online courses for many different popular programming languages like Python, Java, C++, and more. Although there are other online resources for learning programming languages, many of them either cost too much for the average individual or have a disorganized method of teaching. Moreover, few current LMSs are specifically designed to teach only programming languages. By offering a unique LMS tailored for coding courses, our hope is that users can acquire an important new skill for a future career or current hobby while keeping monetary costs at a minimum.

2. Stakeholders

College students

- Students taking courses offered by their university on our LMS
- Students needing to refresh their knowledge of previous courses taken

Hobbyists

- People wanting to learn programming as a new skill
- People interested in applying programming to their field of work

Businesses

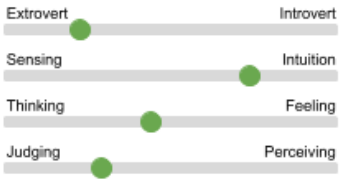
- Business owners hosting programming courses on our LMS to train employees
- Business owners using current courses on our system to train employees

Schools

- Professors hosting programming courses on our LMS to offer accessible online classes

Jimmy Aldrin

Age: 17
Hometown: Lexington, Virginia
Occupation: Student
Education: High school
Coding Proficiency: Low
Languages Known: Python



Goals:
- Learn more about Python and its useful libraries
- Understand basic coding principles
- Become knowledgeable in multiple languages

Needs:
- Clear lessons for beginners
- Quizzes and projects to test knowledge
- Navigable user interface for easy learning

Motivation: Jimmy is skilled at mathematics and wants to have tools to better explore his passions for it. Because of this, Jimmy wants to have a better understanding of Python and its many libraries for math so that he can create simple projects to explore various areas in mathematics.

Bio: Jimmy lives in the small, rural town of Lexington, Virginia. Jimmy's family operates a farm in the area. Because of his living situation, Jimmy has little opportunity to learn about coding in such a rural area. From a young age, he was constantly helping his parents with work in the fields or with the livestock. When Jimmy is not on the farm, he is throwing around the football with his friends or playing video games with them. In school, he became interested in mathematics because of its many applications in the real world, especially to the field of agriculture. Now that he is in high school, he wants to explore the applicability of computer science to math. However, because of his town's size, his high school has never had the ability to host any computer science courses. Therefore, Jimmy searches online for a self directed LMS to learn more about programming.

Use Cases

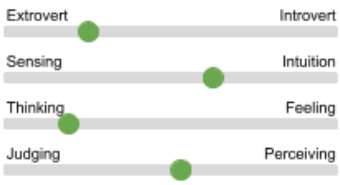
Jimmy wants to learn more about Python and its many popular libraries. He looks up sites to learn programming languages and finds our beginner course on Python. He uses our site as a great introduction into Python and its various uses. After finishing the course, he had a solid foundation in Python.

Jimmy is curious as to what other programming languages would interest him. Using our site's explore function, he is able to see which other lessons we offer. He finds one in C++ and begins to complete it. Because of our website, Jimmy now has the opportunity to explore many lessons which he takes throughout high school.

After a busy semester where Jimmy had little free time to code, he needs to brush up on his Python knowledge. Because our courses are easily navigable, Jimmy goes back to the first course he completed in Python. He skims through the lessons so that he can recall what he learned from them.

Raheem Sterling

Age: 28
Hometown: Irmo, SC
Occupation: Small Business Owner
Education: Masters Degree
Coding Proficiency: Rusty
Languages Known: HTML, Python



Goals:
- Learn how to set up and customize a website
- Develop skills with HTML, CSS, and JavaScript

Needs:
- Fast way to learn so that he can meet his business's needs
- Examples so that he can see how the knowledge he gains is applied

Motivation: Sterling is very hardworking and wants to be knowledgeable in the same areas as his customers. He also wants the practical benefits of programming such as automation and web design. He is motivated to use a service that gives him knowledge and practice in programming as well as how to apply it.

Bio: Raheem Sterling lives in Irmo, SC. He is married with 3 kids and is a small business owner, so he stays very busy. He commutes downtown every day to his electronics repair business. Sterling received a masters degree in electrical engineering and started his own business repairing electrical equipment. Because of Sterling's expertise, he always finds jobs where he has to work on complicated electronic equipment. He also does regular computer repairs and sets up people's computers for them. Sterling wishes to broaden his knowledge and improve his workflow by learning computer programming languages. Sterling wants to teach himself and his employees how to code with a guided learning tool. He asks a friend who recommends that he should use our LMS.

Use Cases

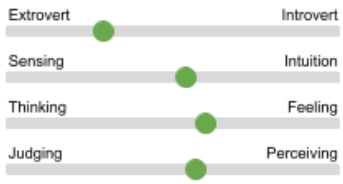
Sterling wants to remake the old website his business is using so that more customers will stop by and consider his services. He uses our service to teach himself HTML, CSS, and JavaScript to make some needed changes.

Sterling took two programming classes while getting his masters degree. He wants to brush up on his knowledge so he can automate repetitive processes that he usually does throughout the day. He also wants to use our LMS to train his employees for similar reasons of automating mundane work.

Sterling wants to become knowledgeable in programming so that he can relate to and converse with his many customers that are in the field of computer science. This will enable him to build better customer relations. It will also allow him to increase his credibility in Irmo and the surrounding areas.

Ben Snyder

Age: 20
Hometown: Charleston, SC
Occupation: Student
Education: University of South Carolina
Coding Proficiency: Medium
Languages Known: Java, C++, C



Goals:
- To master C++
- To learn other languages like Python and JavaScript
- To become a more efficient coder

Needs:
- Lessons similar to those taught in a college setting
- A proper environment to supplement learning

Motivation: Ben is a student who wants to improve his ability to code Java and C++ as well as learn other languages like Python and JavaScript from a beginner level. He also wants to strives to become an expert at coding by the time he graduates for his career.

Bio: Ben lives downtown in Charleston, SC and is a sophomore at the University of South Carolina. He is a computer science major and is decently proficient in coding. He learned Java in high school and has recently learned C++ and C in his previous semesters at USC. Ben is unsure exactly what pathway he wants to take after graduating, but he definitely wants to take courses outside of college to help him become more proficient in the coding languages he has already been taught in addition to new ones. He is also planning on interning over the upcoming summer, and a good LMS will allow him to achieve his full potential.

Use Cases

Ben is taking a class about JavaScript, and his professor wants to assign them a curriculum through an appropriate LMS. She opens up a course for her students so that they can complete their assignments on the LMS.

Ben is taking a class in C++, which he knows a bit about. He needs a proper supplementary course to help him with his assignments. He joins a course on the LMS that helps him learn more about C++ and in turn will allow him to do well in the class.

Ben has an internship opportunity over the summer that requires him to have a basic understanding of Python. He has never formally learned Python, so he joins a course on the LMS to help him learn more about Python.

3. Constraints

Schedule:

- Our schedule for this project consists of two main phases, with each phase lasting multiple weeks.
    - The first phase will be mainly used for brainstorming ideas and deciding on a design pattern that we want to use for our LMS.
    - The second phase will be where most of our development will happen.
- We have a semester to finish this project.

Monetary:

- We have a budget of $0 for this project.

Workplace:

- We will work both in the classroom as a group and from home.
- For communication while at home, we will use both SMS and Discord.
- Whenever necessary, we will organize a meeting in person to work on our project. However, finding a time to meet may sometimes be difficult because of our different schedules.

Technology:

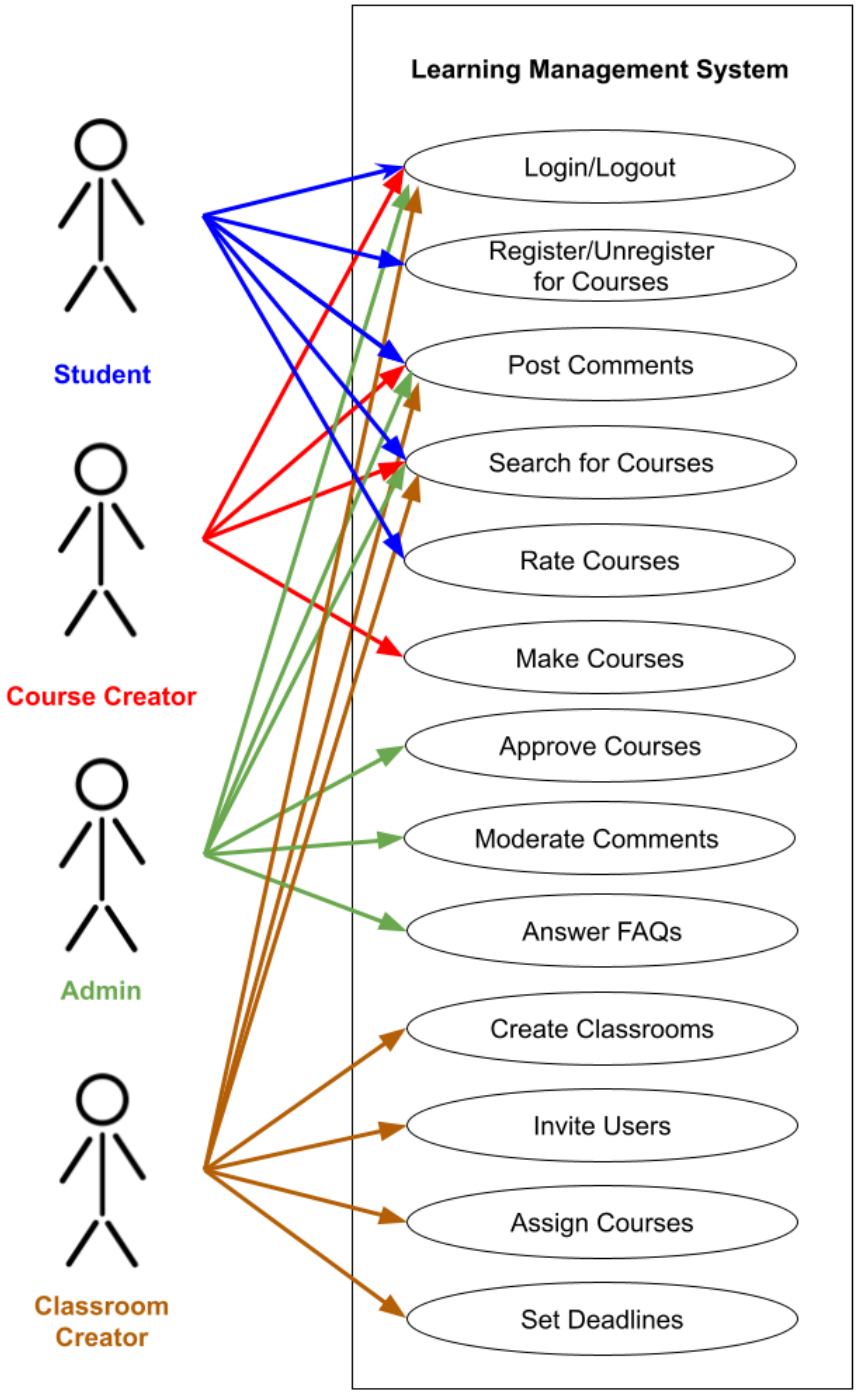
- The entire project must be coded using Java. Our team will write our project on VS Code.
- We will make use of GitHub as a VCS and to keep all our code in an easily accessible place.

4. Overall Description

We plan to have a web based LMS. This way, it can be accessed from any device without worrying about hardware and OS differences. This means that we will need to test our product on many modern browsers to make sure that all browsers are capable of viewing and using our product. Our product will offer courses in all popular programming languages and popular applications of coding (data analysis, machine learning, web design, etc). Users will be able to easily access courses they are currently taking. Universities and businesses will be able to use and host courses on our system for educational or training purposes. We also want to add functionality for users, universities, and businesses to create their own courses so that our course catalog can grow and include a wide variety of lessons.

5. Business Use Case Diagram

Our team came up with different use cases for four common users: students, course creators, system administrators, and classroom creators (such as training managers or teachers). These are they following use cases we predict:



6. Functional Requirements

https://docs.google.com/spreadsheets/d/10qfbM8Nl9ky4_69aGclwAoPgyWDX0XeO3j2yQWjJyTk/edit?usp=sharing

7. Non-Functional Requirements

Look and Feel Requirements

- The color scheme of the system shall be blue and white.

Usability Requirements

- The system shall offer text to speech capabilities for the visually impaired.

Maintainability and Support Requirements

- The application will be available on the following popular browsers:
  - Safari
  - Chrome
  - Firefox
  - Edge
- The system shall have a support team to answer questions from the users.

Security Requirements

- Passwords shall be encrypted for security.
- The user's personal information shall be encrypted for security.

Legal Requirements

- The system shall abide by all applicable internet and copyright laws.

8. Definitions and Acronyms

- **LMS** - Learning Management System. An LMS is a software application used to facilitate online learning by offering a catalog of online courses for users to take. As the popularity of online learning rises, LMSs are becoming much more common for handling education.

- **FAQ** - Frequently Asked Questions. An FAQ page of an online application provides answers to commonly asked questions. These questions are typically focused on how to use the application and help new users better navigate and utilize the program.

9. Competitive Analysis

	Udacity
Strengths	Udacity offers a solution for businesses that allows employees at all levels to benefit from the tools and learning it offers. Businesses can use the courses on Udacity to train their employees in many offered subjects. Udacity has a wide variety of subjects it teaches including data science, ML, cloud, cybersecurity and more. Businesses and users can use Udacity to learn a lot about a wide variety of fields. Udacity has a great approach to tracking progress through time spent on courses to keep the user engaged. Keeping track of time spent on courses also allows the user to view the progress they have made.
Weaknesses	Udacity offers many different learning tools for a wide variety of technologies and topics. This makes Udacity intimidating for newcomers because of the overwhelming amount of content on the site. Like Udemy, Udacity courses offer certificates on completion. However, like Udemy, Udacity courses are not accredited. Still, completing a Udacity course which offers a “nanodegree” is impressive because these courses are made in partnership with industry leaders. Because of the price of their courses, Udacity is not targeting a big market of individuals who cannot spend hundreds to thousands of dollars on online courses.
Audience	Udacity’s main audience is people who have a lot of money to spend and who are looking for comprehensive lessons in a wide variety of topics. Most Udacity courses are priced at over $1000.

	Udemy
Strengths	Udemy offers a great user interface to find relevant lessons. It also offers a “categories” drop down menu to easily search for courses the user wants. Each of the categories has subcategories to help with finer searches. Udemy offers a great rating system with many courses having tens of thousands of reviews. These reviews allow potential users to decide if the course is worth purchasing. They also allow the course creator to view feedback and update their courses based on any criticism. Udemy allows anyone to create a course. This makes it easy for businesses to create courses for their employees to learn about important topics needed for the job. It also allows schools and universities to create lessons for classes to improve the online learning experience.
Weaknesses	The ability for anyone to create a course is also a weakness of Udemy. This causes Udemy’s system to be flooded with thousands of courses. Many of these courses are subpar and have poor ratings. LMSs which offer public courses should strive for a high standard and verify that their site only offers useful courses. Because courses on Udemy can be created by anyone, the certificates a user receives from completing these courses are not accredited. Therefore, they do not carry as much weight as a certificate would from a course made by a university. Although Udemy constantly offers sales on its courses, the base prices are extremely high and overpriced. No user should pay $100+ for an unaccredited certificate and knowledge they could receive from YouTube videos.
Audience	Udemy offers courses in a wide variety of subjects at any level of knowledge. Therefore, Udemy’s audience is anybody who wants to learn new things or advance their knowledge in topics they already know.

	Coursera
Strengths	Coursera offers a large selection of around 3,800 educational courses in which they are partnered with over 200 colleges and universities. This means Coursera users can easily find useful courses. Coursera courses are cheaper than equivalent courses on a college campus. In fact, Coursera offers over 1,500 courses for free. Coursera is very flexible in terms of learning. It allows users to watch lectures at whatever time is most convenient and even gives users the ability to download lectures to view offline.
Weaknesses	Coursera offers “beginner” courses. However, they are often found to be hard and can require prior knowledge on the topic. This can be difficult for people that have no background knowledge and are true beginners. Coursera, while it offers free and inexpensive educational courses, does not give certificates for such courses. Degrees are obtainable only for courses in which an expensive premium (sometimes an upwards of $10,000) is required. Coursera has deadlines for some courses, meaning that users can only enroll in them until a certain time before they are no longer offered.
Audience	Coursera’s main audience is people ranging from beginner to expert on a topic and anyone wanting to learn about a specific subject. Coursera can be a good tool for anyone who needs supplemental learning or a certificate.

Summary:

	Strengths	Weaknesses	Audience
Udemy	+search function +rating system +anyone can create a course	-low quality courses -unaccredited -overpriced	anyone looking for a course in their areas of interest
Udacity	+training employees +variety of courses +tracking progress	-Intimidating for newcomers -unaccredited -overpriced	people with a lot of money who want comprehensive lessons
Coursera	+variety of courses +cheap and free +flexible time frames	-difficult “beginner” courses -accredited degrees are pricey -deadlines on some courses	anyone looking for a course in their areas of interest

Since we are striving to be an accessible platform for everybody, we will likely offer courses at a lower price than the above competitors. One of the biggest problems with Udemy and Udacity is their lack of accredited certificates. Without accredited certificates, finishing courses on these platforms are weak resume items. However, allowing users to post their own unaccredited lesson plans will help diversify the amount of knowledge people can gain on our site. We believe the best course of action will be to offer both accredited and unaccredited certificates. We will allow users to publish unaccredited courses while also partnering with universities to offer courses with accredited certificates. Like all the platforms reviewed above, we will offer courses over a wide variety of fields. These courses will include lessons in Python, Java, C, C++, JavaScript, web design, machine learning, data analysis, and many others. We will strive to offer as many classes as possible and allow users, businesses, and universities to add their own courses so we can have a vast course catalog. Like Coursera, we also want to allow our users to download courses so they can work offline. By providing numerous, easily accessible lessons in computer science, we will satisfy our users’ needs and curiosity by allowing them to take many courses in their areas of interest. Using our platform, users will be able to find an appropriate course for their needs so that they can increase their understanding of computer science while also working towards a meaningful certificate.

10. References

"Software Developers, Quality Assurance Analysts, and Testers : Occupational Outlook Handbook." *U.S. Bureau of Labor Statistics*, U.S. Bureau of Labor Statistics, 9 Sept. 2022, https://www.bls.gov/ooh/computer-and-information-technology/software-developers.htm.