ADDIS ABABA SCIENCE AND TECHNOLOGY UNIVERSITY
COLLEGE OF ENGINEERING
DEPARTMENT OF SOFTWARE ENGINEERING

SOFTWARE COMPONENT DESIGN
PROTOTYPING MODEL

Section C

Name	ID
Elbetel Shineda	ETS0406/13
Leul Mintesinot	ETS0766/13
Mihret Agegnehu	ETS0874/13
Mikiyas Bedasa	ETS0888/13
Natanim Ashenafi	ETS0979/13

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Prototyping Model

The prototyping model is a software development methodology that focuses on creating a preliminary version of a system, called a prototype, to visualize and refine requirements before building the final product [1]. This approach is especially useful when exact project requirements are unclear at the beginning, allowing developers and clients to explore concepts and identify potential issues early in the development process [2].

Process of the Prototyping Model

The prototyping model typically involves the following steps[3]:

1. **Requirements Gathering and Analysis:** Developers and clients collaborate to collect and understand the initial requirements of the software. This stage focuses on identifying the essential features and functionalities desired in the system.
2. **Quick Design:** A preliminary design is created, highlighting the key aspects of the system, such as user interfaces and critical processes. This design serves as the foundation for building the prototype.
3. **Prototype Development:** A working prototype is constructed based on the quick design. This prototype is a simplified version of the intended system, demonstrating core functionalities to provide stakeholders with a tangible representation of the product[4].
4. **User Evaluation:** Stakeholders, including end-users, interact with the prototype to assess its performance and identify any shortcomings or areas for improvement. Feedback gathered during this stage is crucial for refining requirements and design elements.
5. **Refinement:** Based on user feedback, the prototype undergoes modifications to better align with user expectations and requirements. This iterative process continues until the prototype meets the satisfaction of stakeholders[1][3].
6. **Engineering Product Development**: Once the prototype is refined and approved, the final system is developed with a focus on robustness, efficiency, and scalability, incorporating all the validated requirements.

Types of Prototypes

Prototypes can vary in fidelity and purpose, including:

- **Throwaway/Rapid Prototypes:** Built quickly to explore ideas and gather feedback, these prototypes are discarded after their purpose is fulfilled.
- **Evolutionary Prototypes:** Developed iteratively, these prototypes are continually refined and eventually evolve into the final product[6].
- **Incremental Prototypes:** Components of the system are developed as separate prototypes and integrated to form the complete system.
- **Extreme Prototypes:** Often used in web development, this method involves creating a functional user interface first, followed by integrating services and backend functionalities[7].

Advantages of the Prototyping Model

- **Improved User Involvement:** Engaging users early and throughout the development process ensures the system aligns with their needs and expectations[3].
- **Early Detection of Issues:** Potential problems and misunderstandings can be identified and addressed promptly, reducing the risk of costly changes later in development[2].
- **Enhanced Requirement Accuracy:** Prototypes help in clarifying and refining requirements, leading to a more accurate and complete understanding of the system's functionalities[4].
- **Flexibility in Design:** The iterative nature allows for modifications and improvements without significant disruption to the development process[6].

Disadvantages of the Prototyping Model

- **Potential for Scope Creep:** Continuous changes and additions can lead to an unmanageable increase in project scope, affecting timelines and budgets[1].
- **Inadequate Documentation:** Focusing on prototype development may result in insufficient documentation, complicating future maintenance and scalability[2].
- **User Misunderstanding:** Users might mistake the prototype for the final system, leading to unrealistic expectations regarding performance and requirements[4].

Applications of the Prototyping Model

The prototyping model is particularly useful in scenarios where:

- Unclear Requirements: When clients are unsure of their needs, prototypes help in eliciting and defining system requirements [5].
- Complex Systems: For systems requiring user interaction, such as user interfaces, prototypes facilitate better design and usability [6].
- Innovative Projects: In projects involving new technologies or novel solutions, prototyping allows experimentation and validation of concepts [7].

References

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