

# **CHAPTER**

# **2**

## **SOLAR SYSTEM EXPLORATION USING LEAP MOTION**

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### **2.1 INTRODUCTION**

Traditional approaches to teaching the solar system in school science education have heavily relied on textbooks, diagrams, and lectures. Students often encounter static, two-dimensional (2D) depictions of the solar system, limiting hands-on engagement opportunities. While they memorize planetary facts and characteristics, understanding the dynamic nature of astronomical objects and the expanse of space can be challenging (Aksan & Çelikler, 2015). Although traditional teaching methods convey foundational knowledge, interactive elements are necessary to encourage students' deep comprehension and lasting interest. Additionally, comprehending the solar system presents unique hurdles due to its abstract nature and the remoteness of its objects. Unlike observable subjects like plants or animals, astronomical objects are typically beyond direct reach. This absence of tangible experiences necessitates abstract thinking and visualization skills to grasp distant objects' complex dynamics. Similarly, understanding the spatial concept of space is challenging, as physically being present there remains out of reach for most. This gap from everyday experiences points out the need

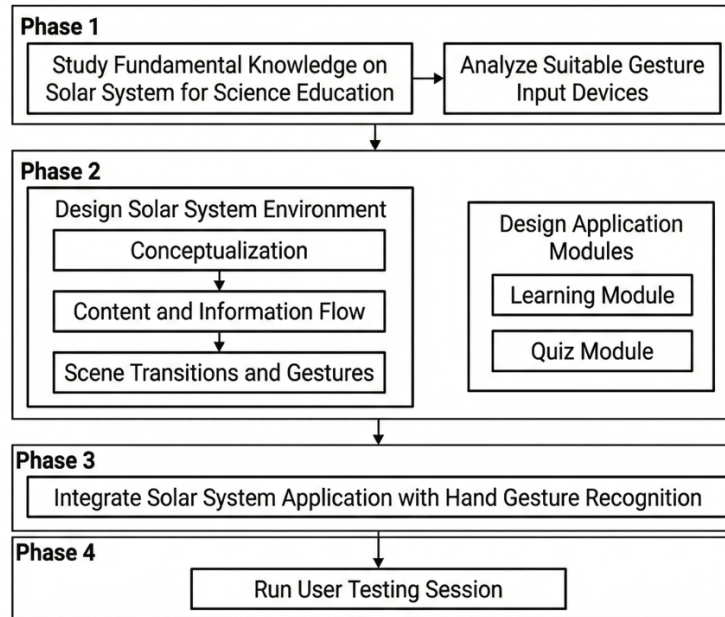
for innovative teaching methods and interactive tools to make the subject more accessible and engaging for students.

As we stand on the brink of a new era in space exploration, the integration of Leap Motion technology presents an exciting frontier for both scientific discovery and education. The ability to interact with complex data and models of the solar system through intuitive hand gestures allows users to transcend traditional learning methods. This immersive experience enhances understanding and fosters a deeper emotional connection to the cosmos, as agreed by Mintz et al. (2001). Moreover, as Leap Motion continues to evolve, we can anticipate even more innovative applications in the field of space exploration. Researchers and scientists could harness this technology to analyze massive datasets from space missions in real time, enabling them to visualize and interact with complex information, thereby accelerating the pace of discovery. The immersive nature of Leap Motion could also facilitate collaborative efforts across institutions, allowing experts to work together in virtual environments, irrespective of geographical boundaries.

## **2.2 INNOVATION APPROACH**

Using virtual reality to visualize the planets of the solar system to aid teaching classes that involve three-dimensional (3D) objects is very useful (Siqueira, 2019). The innovation approach to the solar system application involved conducting studies and analyses to gather relevant information on fundamental knowledge about the system, particularly at the secondary school level. Based on Figure 2.1, the initial stage included research on natural user interaction and gesture input devices to determine the most suitable device for the project. Leap Motion technology was examined to establish the types of hand gestures it can recognize, including static and dynamic gestures. A comparison of various game engines was also conducted to select the one most compatible for the application. Furthermore, existing applications related to the solar system and Leap Motion were reviewed and analyzed to increase comprehension when designing the application and system architecture.

The primary focus of the second phase centered on the design and development aspects of the project. This stage encompasses the methodologies employed for crafting the solar system environment, including concept, content, and scene transition design, as well as hand gesture recognition. Conceptualization considered the solar system's relevance to secondary-level education and the application's exploration nature. Content design entailed structuring course plans and information flow concerning the solar system topic, outlining the environment's layout and modules. The design of the hand gesture involved defining interactions and choosing the gestures that the Leap Motion Device would recognize. Additionally, the scene transition design was implemented to ensure smooth and logical transitions between application scenes.



**Figure 2.1** Systematic approach and workflow

The third phase constituted the implementation stage, where the focus was on developing the simulation for exploring the solar system. Unity 3D and the Leap Motion Device were the primary tools utilized