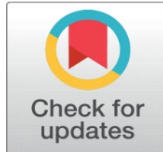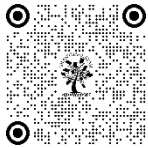# PORTALS IN PANES: THE ART AND SCIENCE OF SPELLBOUND SPECILUM FOR INTERACTIVE LEARNING AT SCHOOLS

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ABSTRACT

This paper, Portals in Panes: The inclusion of the Spellbound Specilum prototype using AI in educational institutions for learning activities will enhance the Interactive Learning Process.

The traditional classroom interactions can be turned into tech-bound communicator by combining a transparent digital display with a two-way mirror, through which can get real-time information dynamically.

The student engagement & learning experiences can be intensified by utilizing voice recognition and augmented reality techniques. This improvises learning through interactive lessons, multimedia presentations etc.,

The complex concepts can be made more accessible and engaging by active learning and collaboration encouraged by Spellbound Specilum which is found by observation.

Spellbound Specilum offers a future view of interactive learning technologies by serving both as a practical tool and beautify the classroom when it is mixed with art and science.

The outcome of the research is that Spellbound Specilum can bring major changes in the current educational methods by providing deep learning capabilities that deliver distinct educational needs and improvise the learning experience completely.

Keywords: Spellbound Specilum, Smart Mirror, Interactive Learning, Augmented Reality, Voice Recognition, Educational Technology, Aesthetic Enhancement, Multimedia Integration

1. INTRODUCTION

In today's fast-evolving educational landscape, fostering curiosity and engagement among students *interactive Learning at Schools"* is an innovative program designed to inspire interactive learning experiences by combining traditional educational techniques with modern advancements in science and technology.

Spellbound Specilum serves as a unique learning tool, to understand complex subjects deeply.

Fig-1: Smart Mirror

2. LITERATURE SURVEY

As an ingenious technology, the smart mirrors are drawing individual's attention in distinct spaces.

The observational usage of smart mirrors delivers various applications:

- **Can be used as Personal Assistants at home**: Smart mirrors can be used at home as Personal Assistance by using voice and touch interfaces user can have access to weather, time, calendar, news and can control smart home devices.
- **Can be used for Interactive advertising at public gatherings:** Here users can try on clothes without changing their outfits through augmenting reality experience which shows them the real-time look.

The smart mirrors have changed the way of using traditional mirror experience by replacing them with interactive and multi-functional devices.

2.1 POST OCCUPANCY EVALUATION (POE)
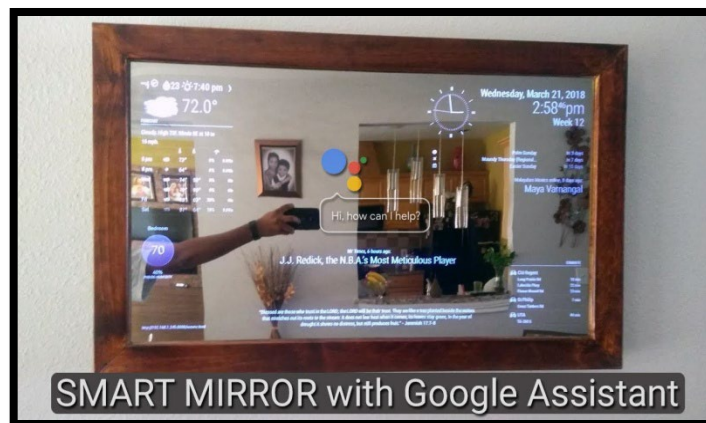## 2.1.1 SMART MIRRORS AT HOME

Fig-2: Smart Mirror at Home

Smart mirrors have transformed the traditional mirror experience at home, replacing standard mirrors with interactive, multifunctional devices. These high-tech mirrors integrate displays behind a two-way mirror, enabling users to access information such as the weather, news, and calendar events while getting ready. Smart Mirrors are the modern design for home décor with daily routines which turns once-simple reflection into a personalized digital hub. Smart Mirrors allows the users to control smart home devices, adjust lightings, play music hands-free using voice assistants and touch-free interactions.

2.1.2 SMART MIRRORS AT PUBLIC GATHERINGS

Fig-3: People Interacting with smart mirror at public gatherings

A smart mirror in a public setting offers a convenient and engaging experience for user by using an interactive mirror featuring sensors and displays. It serves multiple purposes like accessing information, providing information, completion of tasks, entertainment, advertising and many more with a single touch. Widely found at restrooms, hotels, shopping malls, restaurants and other public spaces.

2.2. PROPOSED WORK

The "Spellbound Specilum" is an innovative tool designed to introduce an interactive educational smart mirror specifically for classrooms. Helps students engaging with real-time access to educational content and customized interactive learning resources. It provides a dynamic method for modern classroom lessons by providing quiz features, visual ads and customized subject-specific information with the IoT connectivity, which enable smooth integration with existing school systems. It creates a seamless and interactive experience that motivates students through technology and hands-on learning.
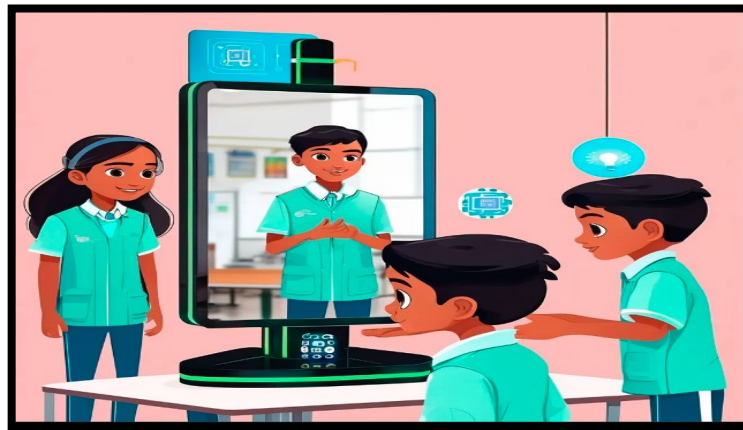

Fig-4: Students Interaction with Spellbound Specilum

3. SYSTEM DESIGN

A smart mirror features a transparent glass panel, which works both on a regular mirror and a screen for digital content. It's system design is a combination hardware and software with connectivity to produce an interactivity, multifunctional display. An LED or OLED screen is used behind this glass that delivers the display with a compact computer or microcontroller (such as a Raspberry Pi) acts as the processing unit.
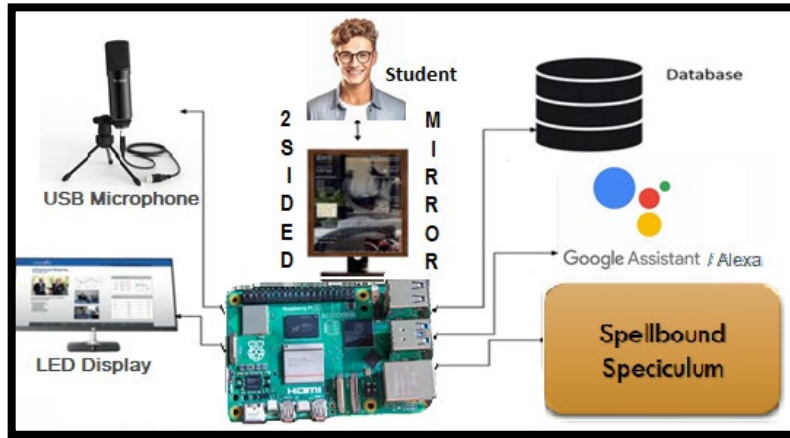
3.1 COMPONENT DIAGRAM

Fig-5: Components Diagram of spellbound Specilum

The component diagram for Spellbound Specilum would typically have several components, including:
2-Sided Mirror Hardware: It acts as an interface between Students and Spellbound Speciculum. The user can ask queries and related information through the smart hardware device which is made of a two-way mirror, a LED display and a USB microphone.

Spellbound Speciculum Application: The spell errors are detected in the user queries. It provides suggestions by the comparison of query with database storage and also with Google Repository.

Natural Language Processing (NLP): The user gestures and commands are interpreted and responded by the Spellbound Specilum allowed by the machine learning based technology called NLP. The user inputs are analyzed and converted into text or action to be handled by Spellbound software is provided by NLP component.

Artificial Intelligence (AI): The different types of user issues that are likely to occur are predicted and the improvements are suggested by AI along with Spellbound applications for its future enhancements.

Database: The database may be needed by Spellbound application for the comparisons of words used in user queries. The suggestions to help the future enhancements can be delivered by database.

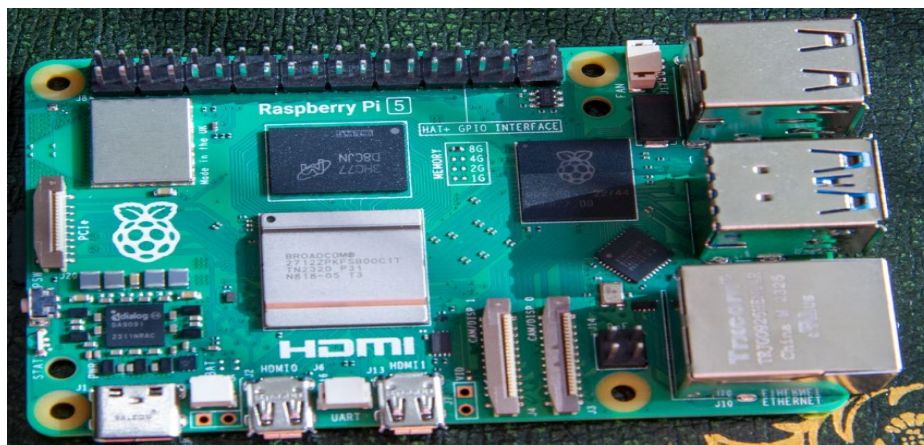## 3.2 CONFIGURATION DETAILS OF RASPBERRY PI 5.

Fig-5: Raspberry Pi 5 Board

- 2.4GHz quad-core 64-bit Arm Cortex-A76 CPU
- Video Core VII GPU, supporting OpenGL ES 3.1, Vulkan 1.2
- Dual 4Kp60 HDMI® display output

- 4Kp60 HEVC(High Efficiency Video Coding) decoder
- Dual-band 802.11ac Wi-Fi®
- Bluetooth 5.0 / Bluetooth Low Energy (BLE)
- High-speed micro SD card interface with SDR104 mode support
- 2 × USB 3.0 ports, supporting simultaneous 5Gbps operation
- 2 × USB 2.0 ports
- Gigabit Ethernet, with PoE+ support (requires separate PoE+ HAT, coming soon)
- 2 × 4-lane MIPI camera/display transceivers
- PCIe 2.0 x1 interface for fast peripherals
- Raspberry Pi standard 40-pin GPIO(General-Purpose Input-Output**)** header
- Real-time clock

4. IMPLEMENTATION
4.1 IMPLEMENTING SPELLBOUND SPECILUM IN SCHOOLS FOR INTERACTIVE LEARNING
Installing *Spellbound Specilum* in school classrooms brings a futuristic approach to interactive learning, blending advanced technology with engaging educational techniques. The standard teaching methodologies can be transformed into fascinating experiences encouraging a hands-on and visually attractive learning environment by implementing AI-enhanced smart mirror with real-time data display and augmented reality.

Important steps to be followed for the installation of Spellbound Specilum applications at Schools.
1. ASSESSMENT OF INFRASTRUCTURE
To find the suitable locations for the installation of Spellbound Specilum units, the amount of space, lighting and connectivity requirements in each classroom are assessed. The assurance for accessing reliable power sources and Wi-Fi is much need since these mirrors rely on digital displays and data updates on real-time basis.

2. INSTALLATION OF HARDWARE
For the better interaction and view for both teachers and students, the smart mirrors with Spellbound Specilum must be placed at a specific height. The installation of the mirror should be done in such a way that it should minimize glare and improvise the visibility for the students.

3. SYSTEM INTEGRATION
The existing educational and learning management systems should implement Spellbound Specilum which allows Teachers to upload the subject content, to manage interactive lesson plans and to get synced with other classroom devices such as smartboards with the mirror.

4. CUSTOMIZATION OF THE LEARNING CONTENTS
The interactive learning modules, augmented reality features and multimedia presentations can be aligned with curriculum requirements by customizing them. The Spellbound Specilum can be used as a tool to adapt distinct educational needs. The Teachers can alter the contents based on different student age groups, subjects and learning objectives.

5. ADEQUATE SUPPORT AND TRAINING FOR TEACHERS
For the better and effective usage of the mirrors through voice recognition commands and to manage interactive lessons, the teachers should be provided with comprehensive training sessions. It boosts confidence in using technology in day-to-day classes.

6. EVALUATION OF SPELLBOUND SPECILUM FROM FEEDBACK WHICH ARE GENERATED
The feedbacks are collected from teachers and students to measure the efficiency of spellbound specilum. Regular evaluation helps in identifying improvement areas.

5. RESULTS

Spellbound Specilum – a smart mirror technology in school, has bought impressive results, and also enhanced student's engagement and better learning outcomes. By adapting advanced artificial intelligence, Spellbound Specilum has proven to be highly efficient in delivering interactive and unique learning experience. For example, in arts and literacy programs, the characteristics of Spellbound Specilum helps student in pronouncing words, engage with virtual characters and also to get immediate response which results in enhancing language proficiency, in simpler words it is a progressive approach in field of education, integrating technology in the traditional teaching method leads to more interactive, customized and effective learning experience
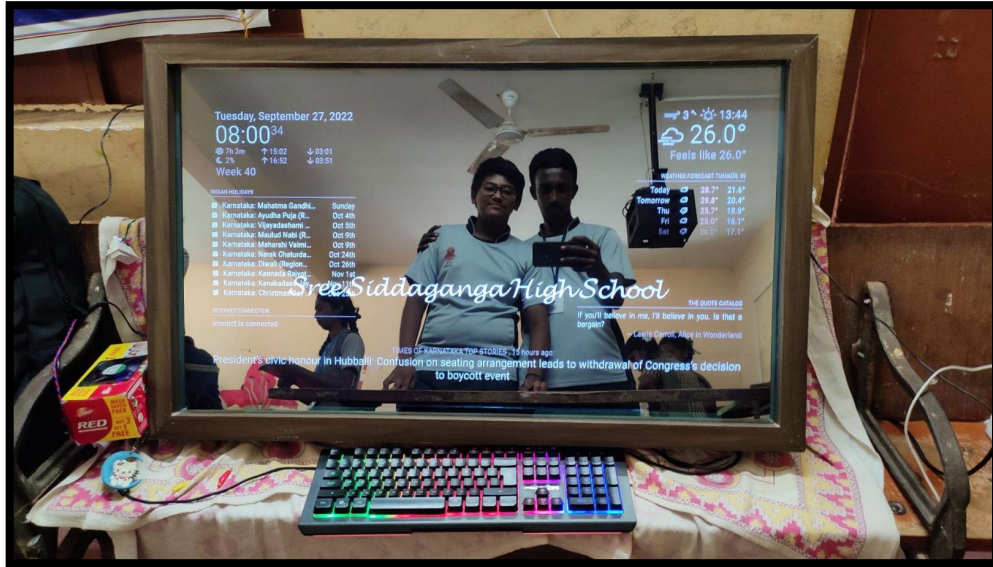

Fig-6: Spellbound Specilum Prototype developed and exhibited for Students

BENEFITS OF SPELLBOUND SPECILUM IN SCHOOLS

- **ENHANCED ENGAGEMENT**: The mirror's interactive features captivate students' attention, making lessons more immersive and engaging.
- **IMPROVED LEARNING OUTCOMES**: Personalized feedback and real-time content updates make complex subjects more accessible, aiding comprehension and retention.
- **INCREASED COLLABORATION**: Group activities and interactive modules promote teamwork and collaborative problem-solving.
- **AESTHETIC AND FUNCTIONAL**: Spellbound Specilum works not just in practical education field but also adds a visual essence in modernizing classroom learning environment.

   By incorporating Spellbound Specilum in education institutions creates a modernized learning experience and equips student to integrate with technology.

6. CONCLUSION

The below graph compares smart mirrors and normal mirrors in field of education with 3 key categories.
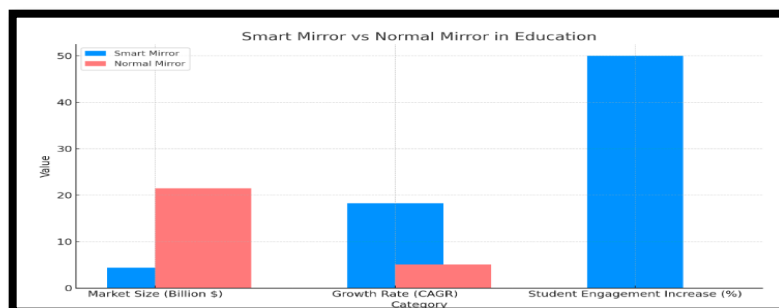

Fig-7: Graph of Growing Importance of Smart Mirrors in Education

- **MARKET SIZE**: Smart mirrors are tend to reach $4.4 billion by 2027 on other hand normal mirrors can have $21.5 billion.
- **GROWTH RATE (CAGR)**: Smart mirrors are observed to scale 18.3% annually, while normal mirrors are 5.1% slower comparatively.
- **STUDENT ENGAGEMENT**: Smart mirrors are likely to improve 50% of student's involvement.
  This graph shows the importance of smart mirrors in field of education by enhancing innovation and involvement yet normal mirrors dominate market size.

CONFLICT OF INTERESTS

None.

ACKNOWLEDGMENTS

None.

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