AI Powered Smart Mirror

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Abstract: This Smart Mirror powered by AI is developed on TinkerCAD for simulation and circuit development. It shows real-time temperature, humidity, and time with the help of an Arduino, TMP36 sensor, PIR motion sensor, and an LCD on a one-way reflective surface for smooth visibility.

A motion sensor turns on the display and LED bulb only upon detecting motion, which further contributes to energy efficiency. Apart from simulation, real-world deployment is proposed with cloud storage for prolonged environmental observation and glass quality assessment. TinkerCAD confirms integration between sensors and displays, demonstrating the capability of IoT and intelligent automation.

1. INTRODUCTION

The Quick advancement of the Internet of Things (IoT) and Artificial Intelligence (AI) has transformed modern life by creating smart home devices that are convenient, efficient, and automated. Among such developments is the smart mirror that utilizes AI, offering a higher level of functionality beyond the use of a standard mirror as it can project real-time environmental data including temperature, humidity, and time. This smart and interactive device improves the user experience through the provision of vital information instantly, thus optimizing daily activities.

This project involves designing and simulating a smart mirror driven by AI in Tinkercad, one of the popular circuit design and prototyping platforms. The setup features an Arduino microcontroller, a PIR sensor to sense the presence of people, a TMP36 sensor to measure temperature, a photoresistor for ambient light sensing, and an LCD for dynamic information display. The use of Arduino ensures real-time processing of data, varying brightness according to light conditions and activating a simulated light upon sensing motion. The presence of these components allows automation, rendering the mirror functional and responsive as a home appliance.

Besides simulation, actual deployment is suggested with cloud storage for extended environmental monitoring and glass quality evaluation. The smart mirror can gather data over time, enabling more profound insights into home conditions and possible improvements. Future updates can also encompass weather forecasting, calendar reminders, and smart home integration, making it more useful than mere environmental monitoring.

TinkerCAD validates effortless interoperability among sensors and displays, showing the strength of IoT and smart automation. The project points out the ways in which emerging technology innovation in AI and IoT is playing its part to make domestic environments more intelligent, connected, and automated. With an assurance of timely display of necessary environmental information and compatibility for additional future capabilities like internet connection and remote control, this smart mirror is an advance towards simplifying user engagement and streamlining home automation solutions.

2. LITERATURE SURVEY

Dabiah A. Alboaneen .This article discusses the use of IoT in smart mirrors, highlighting their uses in home automation, healthcare, and personal assistance. It explains how sensors, microcontrollers, and connectivity are used to improve user interaction. The research also explains the advantages of real-time monitoring of the environment and automation. [1].

S. Benson H. This study is centered on the future prospects of IoT-enabled smart mirrors, with emphasis on sensor technology, AI, and data security advancements. It explains how smart mirrors can enhance everyday efficiency by providing real-time information. The paper also addresses the challenges of merging smart technology with conventional mirrors. [2]

Nathasia Florentina Thejowahyono. This study

examines the role of smart mirrors in education, utilizing Raspberry Pi to create an interactive learning experience. It explores how smart mirrors can display schedules, reminders, and weather updates for students. The paper also discusses the advantages of using AI-powered mirrors for personalized learning environments. [3]

Haneen Fatima. The paper presents the idea of smart mirrors in health and beauty use cases through the concept of the Internet-of-Mirrors (IoM) framework. The paper explains how networked smart mirrors can offer real-time health and beauty advice. The research also investigates AI-based features like facial recognition and skin analysis for customized user experience. [4]

N.Florentina Thejowahyono. This literature survey presents an overview of smart mirror technology with a focus on AI and IoT integration. It explains how smart mirrors can serve as productivity tools by displaying daily updates, reminders, and notifications. The paper also addresses challenges such as data privacy, cost-effectiveness, and hardware limitations. [5].

3. METHODOLOGY

The development of an AI-powered smart mirror is a step-by-step process including system design, circuit simulation, hardware integration, software development, testing, and release. The process begins with the identification of requirements such as displaying current temperature, humidity, and time on a one-way mirror with an LED screen.The key hardware components such as an Arduino microcontroller, DHT11/DHT22 sensor, RTC module, and LED screen are selected for efficient performance. Circuit planning and simulation are done in Tinkercad to ensure proper integration of components prior to implementation. Environmental parameters are sensed using the DHT11/DHT22 sensor, and proper time is ensured using the RTC module. Sensor readings are projected onto the reflective surface of the mirror using the LED display, and data communication is ensured using Tinkercad prior to hardware development.

Hardware integration entails placing the Arduino, sensors, RTC module, and LED display on a breadboard or PCB such that displayed information is observable. A constant power source is employed for constant use. The Arduino is programmed in C/C++ using the Arduino IDE while developing the software to read sensor information and display on the LED display.

Testing and calibration ensure accuracy and reliability through comparison of sensor outputs to reference devices and synchronizing the RTC module with an external reference clock. Brightness and LED display position are optimized for readability. Lastly, the smart mirror is duly installed in its position and tracked for continuous usage. Potential future additions are weather forecasting, calendar reminders, and smart home integration. Utilizing Tinkercad for simulation and Arduino for implementation, the project shows the real-world application of IoT in smart home technology.

4. ARCHITECTURE

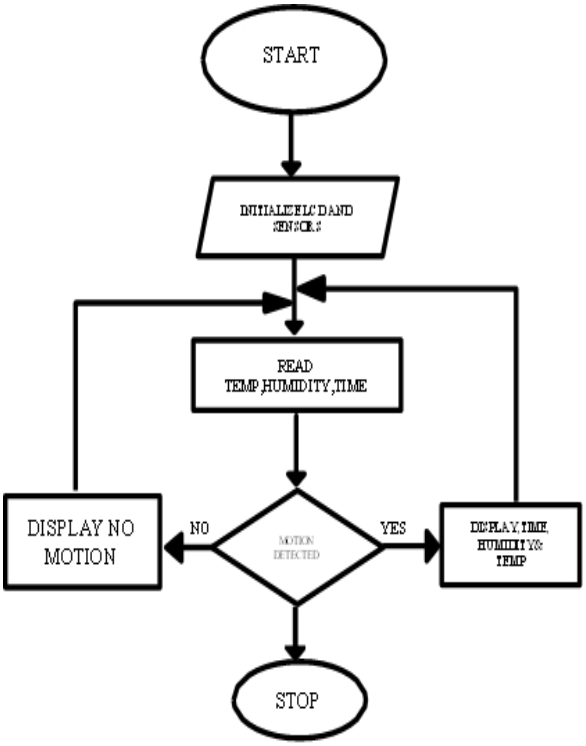

Fig1: Flowchart for AI Based Smart Mirror

5. RESULT

The smart mirror makes use of an AI-based, real-time presentation of time, temperature, and humidity on a one- way mirror via an LCD screen. An Arduino-based solution employs a TMP36 temperature sensor, a mocked-up humidity reading, an RTC-like time refresh mechanism, and a PIR motion sensor to enable intelligent interaction. The motion is sensed using the

PIR sensor, powering the display as well as an LED (replicating a bulb) as a presence indicator, and the photoresistor (LDR) is used to set the LCD backlight level for best viewability.

Sensor readings are accurate, and the time update feature provides uninterrupted timekeeping without the need for an external RTC module. The LCD effectively displays data without impeding the reflective characteristics of the mirror, providing easy-to-read visibility. TinkerCAD simulation played a crucial role in confirming circuit design and reducing possible hardware mistakes prior to implementation. The system functions well with a consistent power supply and smooth sensor interaction.

6. OUTPUTS

Fig2: Circuit Design of AI-Powered Smart Mirror using Arduino in Tinkercad

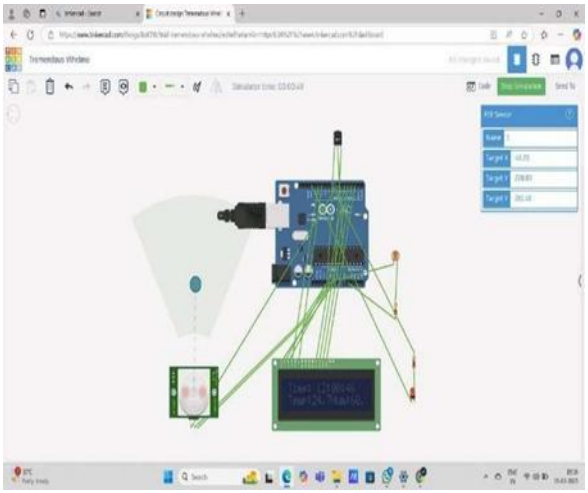

Fig3:Simulated Smart Mirror Displaying Time, Temperature, Humidity and turning on LED when motion is detected in Tinkercad

Fig4:AI Powered Smart Mirror

7.CONCLUSION

This project was successfully able to showcase the use of a Smart Mirror System through Tinkercad and Arduino, incorporating motion detection, weather monitoring, and real-time data visualization. Virtual simulation, designing, and testing were made possible with Tinkercad, which minimized potential hardware faults and streamlined circuit planning prior to actual implementation.

The PIR motion sensor optimizes energy efficiency through sensing movement and triggering the display and bulb to switch on only when required. The TMP36 temperature sensor indicates instantaneous temperature values, whereas the displayed environmental humidity value is a simulation. The LCD display is a user-friendly interface, and it shows time, temperature, and motion activity. The photoresistor (LDR) also controls the brightness of the LCD according to available light so that it is easy to view.

This project identifies the use of IoT and embedded systems in bringing smart automation to everyday objects. Through the use of Tinkercad's simulation feature, we effectively prototyped and tested the system, allowing for smooth sensor communication and proper data visualization. The Smart Mirror System offers a tangible basis for further development in home automation and IoT- based technology.

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REFERENCES

[1] Chethan K. Shetty "REFLECTA - Artificial Intelligence Based Smart Mirror" (2019).

[2] Ghag, K., & Chavan, P. "Smart Mirror using Artificial Intelligence" (2018).

[3] Khandaker Mohammad Mohi Uddin et al. "MirrorME: Implementation of an IoT based Smart Mirror through Facial Recognition and Personalized Information Recommendation Algorithm" (2021).

[4] Haneen Fatima et al. "Internet of Mirrors for Connected Healthcare and Beauty: A Prospective Vision" (2023).

[5] Junyi Yang et al. "Intelligent EC Rearview Mirror: Enhancing Driver Safety with Dynamic Glare Mitigation via Cloud Edge Collaboration" (2024).

[6] Yujia Liu et al. "3D-Mirrorcle: Bridging the Virtual and Real through Depth Alignment in AR Mirror Systems" (2023).

[7] S. Athira et al. "Smart Mirror: A Novel Framework for Interactive Display" (2016).

[8] Jose, J., Chakravarthy, R. J., & D'Souza, S "Home Automated Smart Mirror as an Internet of Things (IoT) Implementation-Survey Paper" (2017).

[9] Piyush Maheshwari et al. "Smart Mirror: A Reflective Interface to Maximize Productivity" (2017).

[10] Vamsikrishna Patchava et al."A Smart Home Automation Technique with Raspberry Pi using IoT" (2015).