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Guiding System for Visually Challenged People by Using IR Sensor and Ultrasonic Sensor

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Abstract

Visually challenged individuals encounter significant difficulties in safely navigating their surroundings due to the inability to detect obstacles in their path. Traditional walking sticks provide limited assistance, as they can only sense obstacles upon physical contact. To address this limitation, this paper presents a smart guiding system designed to enhance mobility and safety for the visually impaired. The proposed system integrates ultrasonic and infrared (IR) sensors into a compact, lightweight smart stick. The ultrasonic sensor detects obstacles at distances of up to four meters by employing echolocation principles, while the IR sensor identifies nearby objects through infrared reflection. An Arduino microcontroller is used as the processing unit to interpret sensor data and provide real-time alerts to the user through audio or vibration feedback mechanisms. Experimental testing demonstrated reliable detection across varying ranges and environmental conditions, significantly improving the user's ability to avoid collisions. The system is energy-efficient, low-cost, and user-friendly, making it suitable for practical deployment in both indoor and outdoor environments. Future enhancements may include the integration of GPS navigation, voice guidance, and IoT-based connectivity to further improve usability.

Keywords

IR Sensor, Ultrasonic Sensor, Arduino, Assistive Technology, Guiding System, Smart Stick

I. Introduction

Visual impairment is one of the major disabilities that affects millions of people worldwide. According to the World Health Organization (WHO), at least 2.2 billion people globally have a vision impairment or blindness. Navigation for visually impaired people is a daily challenge, especially in unfamiliar or crowded environments. Traditional white canes or walking sticks provide basic obstacle detection, but only after physical contact is made, which may result in accidents. Hence, there is a need for innovative solutions to improve safety and independence.

The proposed smart stick system is a cost-effective and portable solution that enhances the conventional walking stick by integrating electronic sensors and microcontrollers. The primary objective of this paper is to design, implement, and evaluate a guiding system that employs ultrasonic and infrared sensors to detect obstacles at varying distances, thereby enabling safer mobility. The contributions of this paper are:

1) Development of a low-cost guiding stick using Arduino, ultrasonic, and IR sensors.
2) Design of a system architecture that integrates real-time feedback for visually impaired users.
3) Experimental evaluation of the system in different environments to test reliability and accuracy.

II. Literature Review

Several researchers have worked on developing assistive devices for visually impaired individuals. In [1], Shrivastava et al. proposed an ultrasonic-based blind stick that could detect obstacles but was limited in range and did not integrate multiple sensors. In [2], Meenakshi et al. developed a smart walking stick using sensor fusion, but the system was relatively expensive and lacked portability. In [3], Sharma et al. designed an Arduino-based assistive device with vibration feedback but tested it only in controlled environments.

Compared to these approaches, the proposed system is simple, low-cost, and integrates both ultrasonic and IR sensors for short- and long-range detection. Additionally, the system is portable and suitable for real-world conditions, making it more practical for visually challenged individuals.

III. System Design and Methodology

The smart stick system is composed of three primary modules: sensing, processing, and output. The sensing module consists of an ultrasonic sensor and an IR sensor. The ultrasonic sensor operates on the principle of echolocation, transmitting high-frequency sound waves and receiving the reflected echoes to calculate distance. The IR sensor detects nearby objects by measuring reflected infrared radiation.

The processing module is an Arduino microcontroller, which collects sensor signals, processes them, and triggers appropriate alerts. The output module

consists of a buzzer and a vibration motor that notify the user when an obstacle is detected. The system is powered by a rechargeable battery, ensuring portability.

The distance to an obstacle is calculated using the formula:
Distance = (Time × Speed of Sound) / 2
where the speed of sound is approximately 340 m/s. For IR sensors, the distance is inferred from the intensity of reflected infrared light.

Figure 1 (System Architecture Block Diagram) illustrates the flow of information between the sensing, processing, and output modules.

A. System Architecture

The architecture of the system can be divided into:
1) Input Unit: IR and ultrasonic sensors.
2) Processing Unit: Arduino microcontroller.
3) Output Unit: Buzzer and vibration motor.
This layered architecture ensures reliable obstacle detection and timely feedback.

B. Working Principle of Sensors

IR Sensor: The IR sensor transmits infrared radiation, which reflects off obstacles and is received by the IR receiver, enabling detection of close-range objects.

Ultrasonic Sensor: The ultrasonic sensor emits ultrasonic sound waves and measures the time taken for the echo to return. The calculated distance allows detection of obstacles within a maximum range of 4 meters.

IV. Implementation and Results

A prototype of the smart stick was implemented using Arduino Uno, an HC-SR04 ultrasonic sensor, an IR sensor, and a buzzer/vibration motor. The stick was tested in both indoor and outdoor environments to evaluate performance. Table 1 shows the detection accuracy for different obstacle distances.

The results indicated that the ultrasonic sensor consistently detected obstacles up to 4 meters, while the IR sensor provided accurate short-range detection within 80 cm. The combination of both sensors ensured reliable obstacle detection in all tested scenarios. The system response time was measured to be under 100 ms, providing real-time alerts to the user.

Figure 2 (Prototype Implementation) shows the physical smart stick model used for testing.

V. Applications

The guiding system has the following applications:
1) Assisting visually impaired individuals for safer navigation in indoor and outdoor environments.
2) Deployment in public transportation hubs such as airports, bus stations, and railway platforms.
3) Extension into wearable devices for mobility support.
4) Affordable solution for visually impaired individuals in developing countries.

VI. Conclusion and Future Work

This paper presented a guiding system for visually challenged people using IR and ultrasonic sensors integrated with an Arduino microcontroller. The system proved effective in detecting obstacles at both short and long ranges, ensuring improved safety and mobility. The proposed solution is cost-effective, portable, and suitable for real-world applications.

Future work will focus on integrating GPS modules for location-based assistance, voice navigation for better user interaction, and IoT-based connectivity for smart city integration. Advanced AI techniques such as object recognition may also be explored to provide richer environmental awareness to users.

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E-COMMERCE IN TIER II AND TIER III CITIES: GROWTH, OPPORTUNITIES AND CHALLENGES

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ABSTRACT

E-commerce growth in India is shifting from metro cities toward Tier II and Tier III regions due to rapid digital adoption, affordable smartphone access, and improved logistics connectivity. As of 2023, nearly 60 percent of total online demand originated from non-metro cities, with an expected annual growth rate of 30 percent by 2025. This study examines the factors driving e-commerce expansion, identifies challenges, and analyzes opportunities in emerging regions. A descriptive research design was adopted, and secondary data was collected from government reports, consulting firm publications, and academic journals. Findings indicate that digital literacy, logistics improvements, and rising aspirations among middle-income consumers are significant contributors to growth, while challenges include trust issues, cash-on-delivery dependency, and infrastructure gaps. The study concludes that Tier II and Tier III cities represent the next decade's largest e-commerce opportunity, provided companies adopt localized strategies and strengthen last-mile delivery.

Keywords: *E-commerce, Tier II and Tier III cities, consumer behaviour, digital adoption, online retail.*

INTRODUCTION

E-commerce in India has undergone a major transition in the last decade. While the initial phase was dominated by Tier I cities such as Delhi, Mumbai, Bengaluru, and Chennai, current trends show rapid adoption in Tier II and Tier III cities. Increasing internet penetration, mobile usage, and changing consumption patterns have transformed smaller cities into new engines of digital growth. According to Bain and Company, more than 202 million online shoppers will come from non-metro cities by 2026. Social commerce platforms, vernacular interfaces, and improved logistics infrastructure have strengthened the growth of e-commerce in these regions.

LITERATURE REVIEW

Kumar and Singh (2020) stated that smartphone penetration and declining data costs are major contributors to online shopping behaviour. Chatterjee and Rathi (2021) observed that the COVID-19 pandemic accelerated digital adoption in Tier II and Tier III cities.

Mitra (2019) found that consumers in non-metro cities prefer branded products, competitive prices, and cash-on-delivery options. Rao and Patel (2020) highlighted logistics constraints, low digital literacy, and trust issues.

Government initiatives under Digital India have played a significant role in reducing the digital divide (MeitY, 2022).

OBJECTIVES OF THE STUDY

1. To analyse the growth of e-commerce in Tier II and Tier III cities.

2. To identify the major drivers of online shopping in emerging regions.

3. To examine the challenges faced by e-commerce companies.

4. To give suggestions for strengthening e-commerce penetration.

GROWTH OF E-COMMERCE IN TIER II AND TIER III CITIES

Increased Internet Penetration

The rapid spread of affordable 4G and 5G internet services has transformed the digital landscape in smaller cities. Low-cost data plans offered by telecom operators such as Jio, Airtel, and BSNL have enabled even middle- and lower-income groups to access the internet regularly. According to industry reports, rural and semi-urban internet penetration has crossed 40 percent and continues to rise steadily. This increase has opened the door for millions of first-time online shoppers who were previously excluded due to limited connectivity.

Rising Disposable Income

Tier II and Tier III cities have witnessed steady economic development driven by the growth of SMEs, service industries, and government employment. This has led to an increase in disposable income among middle-class families. With greater purchasing power, consumers in smaller cities are now more willing to spend on lifestyle products, branded goods, home appliances, and electronics through e-commerce platforms. The

convenience of doorstep delivery and better product variety further encourages online buying.

Vernacular Content and Social Commerce

One of the most important factors supporting e-commerce growth in smaller cities is the availability of regional language content. Platforms like Meesho, JioMart, and Amazon India increasingly provide navigation, product descriptions, and customer support in local languages such as Tamil, Hindi, Telugu, Kannada, Bengali, and Marathi. This helps customers who are not comfortable with English use online services easily. Social commerce, where consumers shop through influencers, WhatsApp groups, and community networks, is also extremely popular in non-metro areas because of familiarity and trust.

Improved Logistics Infrastructure

E-commerce companies have significantly improved their supply chain networks in Tier II and Tier III cities. The establishment of dark stores, local fulfilment centres, and regional warehouses has reduced delivery time and improved product availability. Partnerships with local courier services and the use of technology-driven last-mile delivery solutions have helped e-commerce firms reach remote areas more efficiently. The introduction of micro-hubs and route optimization has ensured timely delivery, even in small towns where transportation facilities are limited. As a result, customers in non-metro cities now receive products almost as quickly as those in metropolitan regions.

CHALLENGES IN TIER II AND TIER III CITIES

Logistics Inefficiencies

Logistics continues to be one of the biggest challenges for e-commerce companies in smaller cities. Poor road connectivity, limited transportation facilities, and inadequate warehousing infrastructure lead to delays in product movement. Many delivery agents must cover long distances or rely on manual routes due to the absence of organized delivery networks. This increases last-mile delivery costs for companies and affects timely delivery for customers. Additionally, certain remote locations still remain outside serviceable areas, restricting complete market coverage.

Low Digital Literacy

Although internet penetration has improved, digital literacy remains low in many rural and semi-urban areas. A significant portion of the population lacks adequate knowledge of how to use e-commerce apps, compare products, track orders, or process returns. Many consumers do not fully understand digital payment options such as UPI, net banking, or online wallets. This lack of digital awareness acts as a major barrier to regular online shopping and reduces confidence in online transactions.

Trust Issues

Consumers in Tier II and Tier III cities often express concerns regarding product authenticity, quality, and reliability of online sellers. Fear of receiving damaged or counterfeit products, doubts about delivery timelines, and worries about incorrect orders make many customers hesitant to shop online. Cases of online fraud, non-delivery, or miscommunication further weaken consumer trust. Building credibility requires consistent service quality, transparent communication, and effective grievance handling.

Cash-on-Delivery Preference

A large proportion of customers in smaller cities prefer cash-on-delivery (COD) rather than prepaid online payments. The preference for COD arises from a lack of trust in online payments, limited usage of credit or debit cards, and fear of financial fraud. For e-commerce companies, COD is more expensive due to handling cash, higher return rates, and logistical complexities. Encouraging digital payments remains a major challenge for companies wanting to reduce operational costs.

Regional Diversity

India's cultural, linguistic, and regional diversity is more pronounced in Tier II and Tier III cities. Consumer preferences vary widely across states, districts, and even within neighbouring towns. Product demand, festivals, fashion tastes, food habits, and price sensitivity differ from one region to another. E-commerce companies must adapt their product assortment, marketing messages, and customer service according to local expectations. Failure to understand these cultural nuances can lead to poor customer satisfaction and reduced sales.

ANALYSIS AND FINDINGS

- ✓ More than 56 to 60 percent of India's online shoppers now come from Tier II and Tier III cities.
- ✓ Fashion, beauty, home essentials, and electronics are the most popular categories.
- ✓ Quick-commerce platforms such as Blinkit and Zepto are rapidly expanding their services across major Indian cities, including

several Tier II locations, and are expected to reach more non-metro regions in the coming years.

- ✓ Social commerce plays a major role in non-metro markets.
- ✓ Trust issues and COD dependency continue to be major challenges.

SUGGESTIONS

Localized Offerings

E-commerce platforms should focus on customizing their product range according to the unique needs and preferences of each region. Consumers in different Tier II and Tier III cities have varied tastes in clothing, food, household goods, and lifestyle products. Providing vernacular language options on websites and mobile apps can make navigation easier for users who are not fluent in English. Localized marketing campaigns, festival-specific promotions, and regionally popular brands can help improve customer engagement and satisfaction.

Strengthening Logistics

To overcome delivery challenges, e-commerce companies should invest in micro-warehousing facilities and local fulfilment centres closer to consumer locations. Partnerships with reliable local courier services can ensure faster and more efficient last-mile delivery. The adoption of route optimization software, GPS-based tracking systems, and technology-driven supply chain solutions will help reduce delivery delays and operational costs. Expanding delivery coverage to remote and semi-urban pockets can also broaden market reach.

Promote Digital Payments

Encouraging digital payments is essential for reducing COD dependency and transaction costs. E-commerce companies can promote online payment options by offering cashback, discounts, reward points, and additional benefits for prepaid orders. Simple payment interfaces, multilingual instructions, and secure gateways can increase consumer confidence. Collaboration with banks and fintech companies can help spread awareness about safe online payment methods and reduce fear of fraud.

Enhance Trust and Safety

Building trust is critical for attracting first-time online shoppers in smaller cities. Companies should ensure the authenticity of products by verifying sellers and displaying clear product information, customer reviews, and ratings. Providing easy return and refund policies, transparent tracking systems, and reliable customer support helps reassure customers. Educating users about safe shopping practices and offering quick grievance redressal mechanisms can further strengthen trust and brand loyalty.\

Digital Literacy Improvement

Improving digital literacy is essential for long-term growth of e-commerce in Tier II and Tier III cities. Awareness campaigns in schools, colleges, women's groups, and community centres can help educate people about how to use online shopping platforms, compare prices, track orders, and make secure digital payments. Training programs conducted in collaboration with local NGOs, government agencies, and educational institutions can increase digital confidence among the population and expand the e-commerce customer base.

CONCLUSION

Tier II and Tier III cities are becoming major contributors to India's e-commerce sector. Increasing digital penetration, rising aspirations among middle-class consumers, and improvements in logistics have transformed buying behaviour in these smaller cities. As a result, regions that were once considered secondary markets are now driving a significant share of online demand. Although challenges such as logistics limitations, low digital literacy, trust issues, and a high preference for cash-on-delivery still exist, these barriers are gradually reducing as awareness and infrastructure improve. With focused efforts on localization, customer trust-building, and efficient last-mile delivery systems, e-commerce companies can fully tap into the large and growing potential of these markets. Overall, the future of e-commerce in Tier II and Tier III cities is promising, and continued investment in technology, logistics, and customer education will further accelerate growth in the years to come.

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Albert Einstein: Life, Scientific Contributions, and Legacy

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Abstract

Albert Einstein is widely celebrated not only as a revolutionary scientist but also as a transformative figure in education and intellectual thought. His theories of relativity and contributions to quantum mechanics reshaped our understanding of the universe, while his approach to scientific inquiry and problem-solving serves as a model for educators and students alike. This educational article provides a detailed account of Einstein's life, scientific achievements, teaching philosophy, and enduring impact on science education, emphasizing lessons for learners and educators in contemporary contexts.

Keywords : Albert Einstein, Relativity, Quantum Theory, Physics, Education, Scientific Legacy, Learning, Teaching

1. Introduction

Albert Einstein, often regarded as the epitome of genius, transformed physics and reshaped the way humanity understands space, time, and energy. Beyond his scientific breakthroughs, Einstein's intellectual curiosity, teaching philosophy, and dedication to knowledge make him a timeless figure in education. His life story illustrates how perseverance, creative thinking, and questioning of established norms can lead to transformative learning experiences. Integrating Einstein's insights into modern education encourages students to develop critical thinking, curiosity, and interdisciplinary learning skills.

2. Early Life and Formative Education

Albert Einstein was born on 14 March 1879 in Ulm, Germany, into a middle-class Jewish family. His father, Hermann Einstein, was an engineer and entrepreneur, and his mother, Pauline Koch, encouraged his early interest in music and intellectual pursuits. As a child, Einstein showed remarkable curiosity about nature, mathematics, and geometry, though he struggled with rigid school systems that emphasized rote learning. His fascination with a compass at the age of five sparked questions about invisible forces, demonstrating early analytical thinking. Einstein's schooling in Germany was marked by both brilliance and rebellion; he often questioned teachers and curriculum, a trait that later defined his independent thinking. At age 17, he enrolled in the Swiss Federal Polytechnic in Zurich, Switzerland, where he pursued formal education in physics and mathematics. Despite academic excellence, Einstein initially struggled to secure an academic post, which led him to work at the Swiss Patent Office in Bern—a period that fostered creativity and reflection, ultimately leading to his groundbreaking discoveries.

3. Annus Mirabilis (1905) and Major Discoveries

The year 1905, known as Einstein's *Annus Mirabilis* or "miracle year," witnessed the publication of four seminal papers that transformed physics and education in scientific thinking.

Special Theory of Relativity

Einstein introduced the special theory of relativity, challenging classical concepts of space and time. Key principles include:

- The laws of physics are identical for all inertial observers.
- The speed of light in a vacuum is constant, irrespective of motion.
- Time dilation and length contraction, illustrated by thought experiments such as moving clocks and trains.

The famous equation $\mathbf{E = mc^2}$ shows the equivalence of mass and energy. Educationally, this theory encourages learners to think conceptually, use imagination, and question assumptions in physical laws.

Photoelectric Effect

Einstein's explanation of the photoelectric effect proposed that light consists of discrete energy

packets called photons. This work provided experimental evidence for quantum theory and earned him the Nobel Prize in Physics in 1921. In the classroom, this principle illustrates how observation and experimentation underpin scientific knowledge and introduces students to quantum concepts in an intuitive way.

Brownian Motion

By explaining the erratic movement of particles in fluids, Einstein confirmed the existence of atoms and molecules. This work bridges theoretical physics with observable phenomena, offering practical experiments for educational laboratories.

Implications for Science Education

Einstein's 1905 papers collectively demonstrate the power of critical thinking, creativity, and empirical verification. These principles are foundational in science education and provide pedagogical examples for teaching problem-solving and inquiry-based learning.

4. General Theory of Relativity

In 1915, Einstein presented the general theory of relativity, redefining gravity as the curvature of spacetime caused by mass and energy rather than a conventional force. Confirmed during the 1919 solar eclipse, the theory has profound implications for cosmology, astrophysics, and educational demonstrations.

Teaching relativity offers students the opportunity to explore:

- Conceptual frameworks of space and time
- Visualization of complex scientific ideas
- The importance of observation, prediction, and experimentation in theoretical physics

Einstein's approach to relativity also emphasizes the integration of mathematics and physical reasoning, providing a model for STEM education.

5. Contributions to Quantum Theory and Other Scientific Fields

Einstein contributed to multiple areas beyond relativity, including:

- **Quantum Mechanics:** Insights into photons, stimulated emission, and quantum statistics.
- **Statistical Mechanics:** Work on molecular motion and thermodynamics.
- **Cosmology:** Introduction of the cosmological constant.

Despite his role in quantum theory, Einstein maintained a philosophical stance on determinism, inspiring debates on the nature of reality—valuable for critical thinking exercises in higher education.

6. Later Life, Teaching, and Social Engagement

Einstein moved to the United States in 1933, joining Princeton's Institute for Advanced Study. Beyond research, he was a passionate educator and mentor, emphasizing curiosity, independent thinking, and ethical responsibility in science. His advocacy for peace, civil rights, and international collaboration demonstrates how scientists can impact society, a lesson for students integrating social awareness with scientific literacy.

7. Legacy in Education

Einstein's legacy extends to classrooms worldwide. Key educational lessons include:

- Encouraging inquiry and questioning rather than rote memorization
- Integrating imagination with rigorous scientific reasoning
- Using thought experiments to simplify complex scientific concepts
- Inspiring interdisciplinary learning across physics, mathematics, philosophy, and history

His life serves as a model for developing lifelong learners who value creativity, analytical skills, and global awareness.

8. Personal Perspective and Relevance Today

Einstein's philosophy teaches students and educators the importance of:

- Curiosity-driven learning
- Independent thought and perseverance
- Ethical and social responsibility in scientific pursuits
- Embracing complexity while seeking conceptual clarity

In modern classrooms, incorporating Einstein's theories and life stories fosters engagement, encourages critical analysis, and develops problem-solving abilities that prepare students for advanced scientific challenges.

9. Conclusion

Albert Einstein revolutionized scientific understanding and shaped the educational landscape through his ideas, teaching philosophy, and life example. His work continues to inspire students, educators, and researchers to think critically, question assumptions, and pursue knowledge creatively. By integrating his insights into science education, learners are encouraged to cultivate curiosity, interdisciplinary thinking, and a passion for lifelong learning, ensuring Einstein's legacy endures for generations.

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Exploration of Cultural Journey through Spices & Herbs: Analyzing Divakaruni's

Mistress of Spices

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Abstract

Diasporic writers embark on a journey of cultural dissemination, transporting the essence of their native heritage across the globe through their literary endeavors, thereby forging a vital link between their homeland and their newfound abode. While diasporic literature was once characterized by a pervasive sense of nostalgia and displacement, today it presents a more optimistic portrayal of individuals' adept at embracing change. These writers adeptly navigate the interstitial space between cultures, effectively bridging the gap through negotiation and adaptation. The profound sense of displacement and existential anguish experienced by immigrants in the past has been somewhat assuaged by the advent of various social networking platforms. Employing the medium of fiction, diasporic writers find ample canvas to depict characters grappling with diverse challenges in unfamiliar territories. Chitra Divakaruni, renowned for her poignant narratives, skillfully captures life's pivotal moments, breathing life into dynamic characters that epitomize the rich tapestry of her native culture.

Keywords: Cultural Diversity, Diasporic Communities, Botanicals, Seasonings, Literary Works

Over the past two decades, Indian diasporic writers have taken a prominent position, primarily due to the theoretical concepts emerging from their literary works. They utilize their writing as a means to establish a connection between their native country and their new home. Their writing reflects their homeland's culture while also navigating and embracing the cultural landscape of their adopted land. The characters they depict often exist on the fringes of two cultures, carving out a space of belonging in between. However, the profound sense of displacement experienced by immigrants remains authentic and intense. Nonetheless, recent developments suggest that this anguish has somewhat diminished, thanks to the rise of social networking and a growing sense of solidarity within diasporic communities. This feature is magnificently exposed by Bhikhu Parekh who opines:

the Diasporic Indian is "like a banyan tree, the traditional symbol of the Indian way of life, he spreads out his roots in several soils, drawing nourishment from one when the rest dry up. Far from being homeless, he has several homes, and that is the only the way he increasingly comes to feel at home in the world. (106)

Diasporic literature, in a broader sense, serves as a means to comprehend diverse cultures, bridging gaps between nations, globalizing perspectives, and fostering universal peace.

Chitra Banerjee Divakaruni stands as a prominent figure in diasporic literature. Her narratives intricately weave Indian cultural elements such as food, attire, rituals, language, and religious practices, leaving a lasting impression on readers. This study aims to highlight the invaluable wisdom of Indian spices and herbs for healing, a fundamental aspect of Indian culture. Divakaruni skillfully incorporates this ancient knowledge of Indian Ayurveda into The Mistress of Spices.

Immigrant writers like Divakaruni are deeply rooted in their cultural heritage, evident in their works which promote and project various aspects of their native land. Acting as cultural ambassadors, they enhance the understanding of their culture and traditions. Culture encompasses the social behaviors and norms of a community, passed down through generations. The profound knowledge of Indian Ayurveda, with its globally recognized healing properties, is eloquently presented in Divakaruni's tale, serving as a conduit to showcase the value of Indian spices to the world. While India is renowned for its mysticism and yogic culture, "The Mistress of Spices" offers a fresh perspective by delving into the depths of Ayurvedic wisdom. Through literature, India's diverse knowledge base, spanning science, mathematics, medicine, technology, astronomy, and cuisine, is made accessible to a global audience. Divakaruni's imaginative storytelling portrays a unique portrayal of her homeland.

The narrative revolves around Tilo and her adeptness with spices. Born as Nayan Tara, she possesses special abilities to foresee events. Captured by sea pirates, she eventually finds refuge on an island, where she learns the art of spice control from an ageless woman. Renamed Tilo, she becomes the "mistress" of spices in Oakland, bound by strict rules governing her powers. The plot captivates readers with its thematic chapter titles hinting at the properties and usage of spices. Divakaruni eloquently illustrates how spices not only add flavor to life but also offer solutions to physical and mental challenges, as seen through Tilo's healing practices. Her trainer, Old One has taught her that “different spices may help us with different troubles, and for each person, there is one special spice”. (71)

Tilo applies sandalwood powder on Haroun's palm to alleviate his haunting memories. She provides Daksha with black pepper to empower her to assertively reject the patriarchal norms imposed by her family. Almond powder is given to Kesar and Gita's grandfather to sweeten their

speech and thoughts, while lotus root powder is offered to Hameeda to nurture love within her. This unique association of spices with human experiences and their link to Hindu mythology imbues the novel with a mystical quality. The author personifies spices as entities with supernatural abilities. The chapters are titled after different spices, starting with 'Tilo,' derived from 'Til,' followed by 'Turmeric,' 'Cinnamon,' 'Fenugreek,' 'Asafetida,' 'Fennel,' 'Ginger,' 'Peppercorn,' 'KaloJire,' 'Neem,' 'Red Chilli,' 'Makardwaj,' 'Lotus Root,' and 'Sesame.' In an interview with UCTV, Divakaruni elaborated on the importance of spices in the novel: “The spices are very important in this book, as characters they have personalities of their own, different sections of novels are named after them, these are the sections where they play an important part, and they develop a relationship with Tilo and speak to her show their love and anger.” (Divakaruni)

Divakaruni remains connected to her cultural heritage and aims to promote the global recognition of the ancient healing practice of Ayurveda, deeply rooted in Indian culture, through her work. In the novel, Divakaruni depicts her protagonist, Tilo, as a proficient spice healer, drawing upon her extensive knowledge of Indian spices. Tilo, the central character, stocks her store with a comprehensive collection of "every Indian spice." “The spices are my love…They are the ones I work with….every Indian spice that ever was - even the lost one’s - gathered here upon the shelves of my store…I say there is no other place in the world quite like this. (04) Tilo hails from a place described as the "land of passionate poetry and vibrant feathers." She possesses a profound understanding of the significance of each spice and its appropriate usage.

I know their origins, and what their colors signify and their smells. I can call each by their true-name it was given at the first when earth splits like skin and offered it up to the sky. Their heat runs in my blood, they bow to my command. At a whisper they yield up to me their hidden properties, their magic powers…you have forgotten the old secrets … (03)

The Indian subcontinent has long been renowned as a "land of spices." Author Chitra Banerjee Divakaruni, hailing from India, astutely selects various Indian spices known not only for their culinary uses but also for their medicinal properties. These spices are seamlessly integrated with fictional elements to serve the narrative's purpose.

Turmeric, known scientifically as Curcuma Longa and originating from the Arabic word Kurkum, holds a special place. In Sanskrit, it is referred to as "Haridhara," signifying its golden hue. Highly valued for its healing abilities, preservative qualities, and spiritual significance, turmeric is deeply ingrained in Indian customs. It is often applied to newborns for luck and used in religious rituals. Tilo utilizes turmeric powder to treat her customers' wounds and even places it in Lalita's bag along with prayers to alleviate her suffering.

Similarly, cinnamon, also known as Dalchini, is a fragrant spice derived from the inner bark of the Cinnamomum tree. Beyond its aromatic qualities, it boasts medicinal properties such as improving

glucose levels and aiding diabetics. Tilo strategically places a cinnamon stick in Jagjit's turban to help him make friends at school and gain strength. “destroyer of enemies to give you strength, strength which grows in your legs and arms and mostly mouth till one day you shout ‘no’ loud enough to make them, shocked, stop” (40). Fenugreek is a petite, annual plant characterized by its leaves composed of three small oblong leaflets. Both the leaves and seeds are utilized as a fragrant spice and possess healing properties. Rich in antioxidants and essential nutrients, fenugreek's origins trace back to its initial planting by Shabari, the world's oldest woman. Despite its bitter taste, fenugreek has the remarkable ability to purify the body, preparing it for love. Tilo employs this spice to treat Ratna's poisoning in her womb and Binita's breast cancer.

Asafetida, on the other hand, is a sulfurous, onion-scented resinous gum extracted from the root-stock of the Ferule asafetida plant. The term "Ferule" denotes "carrier," while "as" refers to resin and "felid" signifies an offensive odor. Despite its pungent smell, asafetida holds significant medicinal value. It is utilized to address various ailments such as hysteria, loss of appetite, ulcers, flatulence, respiratory disorders, and has anti-helminthic properties. In The Mistress of Spices, it is referred to as ‘an antidote of love’ (74). Fennel, originating from the Mediterranean, is a subtly flavored and sweetly aromatic seed spice. It offers relief from conditions like anemia, indigestion, and respiratory disorders when consumed in small quantities after meals. Additionally, it freshens breath, aids digestion, provides mental fortitude, and helps temper one's emotions. Furthermore, it is known to enhance brain function. Tilo administers fennel to Ahuja's distressed wife, who requires mental strength due to Ahuja's unfavorable behavior.

Ginger, sourced from the underground rhizomes of a perennial herbaceous plant, is renowned for its golden variety used by the healer Charak to rekindle digestive fire. As an Asian spice, ginger possesses unique properties to alleviate nausea and pain, and Tilo herself consumes it in a hot concoction. Moreover, it promotes bone health and bolsters the immune system. Black pepper, derived from a flowering vine, is valued for its dried fruits used both as a seasoning and for medicinal purposes. It aids digestion by stimulating digestive secretions, relieves peptic ulcers, alleviates cold and cough symptoms, fights infections, and enhances perspiration. With its ability to draw out hidden desires, black pepper is utilized by Tilo to encourage Daksha to assert herself, a challenging task for many Indian women.

Kalo Jire, or black cumin seeds, offers an array of health benefits, including protecting against various diseases, maintaining heart health, controlling high blood pressure, combating cancer, supporting liver function, aiding weight loss, and promoting overall well-being. This is the feasible cause for Tilo sprinkle the seeds “for all who have suffered from America” (173), and particularly to Haroun for his security. Neem, scientifically known as Azadirachta indica and native to the Indian subcontinent, is renowned worldwide for its medicinal attributes. All parts of the neem tree are utilized for their therapeutic properties, with its leaves demonstrating immunomodulatory, anti-inflammatory, antihyperglycemic, antiulcer, antimalarial, and antibacterial effects. Tilo applies a paste of neem leaves to her skin for cleansing, disinfection, and beautification purposes.

Red chilli, the fruit of the capsicum plant belonging to the nightshade family, is a rich source of vitamins A and C. Its excessive consumption can cause a burning sensation. Divakaruni employs this spice as a potent symbol with the power to wreak havoc, hailing from Lanka, a harbinger of danger. Originating from Agni, the god of fire, it is considered a purifier of evil. Makaradwaj, an Ayurvedic medicine containing herbal and mineral ingredients, including mercury sulfide, should only be taken under strict medical supervision to avoid harm. It is renowned for its anti-aging and aphrodisiac properties, enhancing heart strength and immunity. Divakaruni refers to Makardhwaj as the conqueror of time, and Tilo uses it to enhance her beauty.

Various other spices and herbs, such as lotus root, coriander seed, amchur, mahamul, tulsi, hartuki, and sandalwood, are also discussed for their respective symbolic and medicinal significances, including their effects on emotional and physical well-being. Divakaruni's novel reflects her extensive research on Ayurveda, incorporating this knowledge into the narrative. In one of her conversations, she says that: I have been interested in the traditional ancient Hindu system of medicine, for a long time so I did a lot of ayurvedic research as well. At Berkeley and in the Bay area, there are a lot of ayurvedic practitioners and you can get a lot of books as well. So I did do a lot of Ayurvedic research. Some of it came out of, again, the folklore of Bengal, the ways in which spices were used in my home when I was growing up, not for cooking but for medicinal purposes. There are some good luck spices. You have certain ceremonies where you would use certain spices to bring good luck and avert the evil eye—the mustard seed to avert

the evil eye and the haldi, which is auspicious. (Seshachari Neila 2001)

Through thorough examination of spices, Divakaruni skillfully portrays her characters as both enchanting and resilient. Inderpal Grewal similarly perceives "The Mistress of Spices" as embodying an exotic aesthetic, blending Hindu mysticism and timeless wisdom, deeply rooted in India's cultural heritage. He remarks on the use of spices in the novel:

This narrative of ancient and modern [....] sutures the world of late twentieth century cosmopolitan travel and cuisine with American cultural feminism's new translational spiritualities that enable non- western goddess. Exotic power is empowerment, and feminism and exoticism are first demarcated and reconciled. Exotic spices enable women to become feminist subjects by using their magical and healing qualities to fight patriarchal Indian traditions (77).

Divakaruni incorporates ancient wisdom of spices and herbs into her narrative, enriching the tapestry of culinary fiction. In The Mistress of Spices, she imbues spices with healing properties, granting them a lifelike presence within the story. As Divakaruni describes, these spices transcend mere flavoring, possessing magical powers and offering remedies for physical ailments and spiritual afflictions. Literature's greatness lies in its universality, transcending specific societies or communities to speak to humanity as a whole. Diasporic writers, through their expressive narratives, offer diverse insights into their native cultures. Art serves a purpose beyond its own existence; a profound piece of literature enriches life and benefits the entire world.

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LIBRARY AND ITS USES

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Introduction

A library is a collection of books, magazines, digital resources, and other learning materials, organized for reading and study. Libraries have existed since ancient times as storehouses of wisdom. They offer a peaceful environment that helps students grow intellectually and morally. Access to books and reference materials broadens knowledge, while the quiet ambiance encourages concentration, making both personal and academic growth possible.

The primary purpose of a library is to make knowledge accessible to everyone without discrimination. A public library welcomes people from all backgrounds, often free of cost. This support is invaluable for those who cannot afford to buy books. Students preparing for examinations, writing essays, or seeking to understand history and science rely on libraries as trustworthy sources. Great leaders such as Swami Vivekananda and Dr. B. R. Ambedkar attributed much of their knowledge to the years they spent in libraries.

The library is a special place where books on every subject are available for everyone's use. Students depend on libraries to find information for their studies, complete projects, and develop good reading habits. It is a quiet place for focused work. Libraries provide storybooks, reference books, magazines, and newspapers, helping to build vocabulary and general knowledge. As not all families can afford many books, libraries offer equal learning opportunities to all. Modern libraries also include e-books and internet resources, adapting to changing times. The calm environment of a library encourages concentration and discipline, supporting both academic and personal growth.

Libraries also instill good reading and study habits. They foster curiosity and the joy of learning. Students develop critical thinking skills by comparing different authors' viewpoints. Libraries encourage group study, idea exchange, and even social interaction among peers with similar interests. In modern times, libraries offer more than physical books; they provide newspapers, magazines, e-books, and curated digital content. Libraries ensure access to authentic and credible information, even on the internet.

The library and its uses must also be considered. Libraries support learning and offer a distraction-free study zone. However, some disadvantages include limited opening hours or outdated collections if they are not well-funded. The need for technological upgrades is becoming increasingly important to remain relevant for the digital generation. Libraries enable learning beyond classrooms and are ideal for assignments, homework, and quiet reflection. The nurturing environment of a library benefits every student.

Conclusion

In conclusion, libraries are far more than mere collections of books; they are sanctuaries for lifelong learning and personal development. They guide us from ignorance to wisdom, shaping responsible, curious, and knowledgeable individuals. To ensure their future, both governments and communities must invest in and promote library usage, blending traditional and digital resources for the next generation.

Interesting Physics Concepts

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Why seat belts save lives – Inertia in daily life

Seat belts save lives because of the principle of inertia, which is the tendency of an object to resist any change in its motion. When a car suddenly stops or crashes the passengers inside tend to keep moving forward at the same speed due to inertia. If they are not wearing seat belts, they may hit the dashboard, windshield or other objects, causing serious injury. A seat belt holds the passenger in place, slowing them down safely along with the car and preventing them from being thrown forward.

Why metal feels colder than wood

Metal feels colder than wood not because it is actually colder, but because of thermal conductivity. Metal is a good conductor of heat, which means it draws heat away from your hand very quickly. When you touch metal, it rapidly takes heat from your skin, making your hand feel cold. Wood on the other hand is a poor conductor (insulator), so it takes heat from your hand very slowly and therefore feels warmer.

Why the sky is blue and sunsets are red

Why the Sky is Blue

The sky appears blue because of Rayleigh scattering. Sunlight contains all colors of light, but the shorter wavelengths (blue and violet) scatter more in the Earth's atmosphere than longer wavelengths (red and orange). Our eyes are more sensitive to blue, so the sky looks blue during the day.

Why Sunsets are Red

During sunrise and sunset, the Sun is near the horizon, and sunlight passes through more atmosphere. Most of the blue and green light gets scattered away, leaving the longer wavelengths (red, orange, and yellow) to reach our eyes. That's why the sky near the Sun appears red or orange at sunset and sunrise.

Machine Learning Techniques

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Machine Learning is a technique in artificial intelligence that allows computers to learn from data and improve automatically without being programmed again and again. It helps machines find patterns, make decisions, and give predictions.

Machine learning techniques are used to train computers using data so that they can solve real-world problems efficiently. These techniques are very useful when dealing with large amounts of data.

One important machine learning technique is **supervised learning**. In this technique, the machine is trained using labelled data. This means the input and output are already known. The system learns by comparing its predicted result with the correct answer and improves its accuracy over time. Supervised

learning is commonly used in email spam detection, result prediction, and medical diagnosis.

Another technique is **unsupervised learning**. In this method, the machine works with unlabelled data. The system tries to find hidden patterns or group similar data without any prior knowledge. Unsupervised learning is useful in customer grouping, market analysis, and identifying patterns in large datasets.

Reinforcement learning is a learning technique where a machine learns by interacting with its environment. The system receives rewards for correct actions and penalties for wrong actions. Over time, it learns the best actions to achieve its goal. Reinforcement learning is used in robotics, games, and self-driving cars.

Deep learning is an advanced machine learning technique that uses artificial neural networks inspired by the human brain. It processes data in multiple layers and is very effective for complex tasks like image recognition, speech recognition, and language translation. Deep learning requires large data and powerful computers.

In conclusion, machine learning techniques help computers learn from experience and make intelligent decisions. These techniques play a major role in modern technology and will be very important in the future.

Machine Learning Overview

Data → Machine Learning → Prediction

Neural Network (for Deep Learning)

Input Layer → Hidden Layer → Output Layer

E-Marketing - Article

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E-marketing, also known as digital marketing, is the use of electronic media and the Internet to promote products and services. With the rapid growth of technology, e-marketing has become an important part of modern business activities. One major advantage of e-marketing is its ability to reach a global audience. Businesses can advertise their products through websites, social media platforms, email, and search engines, allowing them to communicate with customers quickly and effectively, regardless of location. E-marketing is also cost-effective when compared to traditional marketing methods such as television, newspapers, and billboards. Even small businesses can promote their products with a limited budget and still achieve good results. Online marketing tools enable businesses to target specific customers based on their interests and behavior. Another important feature of e-marketing is performance measurement, as businesses can track customer responses, website visits, and sales in real time. This helps marketers improve their strategies and provide better services to customers. In conclusion, e-marketing plays a vital role in today's digital world, and its wide reach, low cost and measurable results make it an essential tool for business success.

Brain-Computer Interface (BCI)

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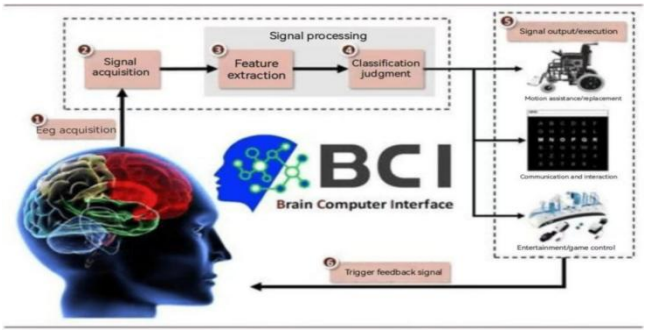
A **Brain-Computer Interface (BCI)** is a technology creating a direct communication pathway between the brain's electrical signals and an external device, bypassing normal neuromuscular routes to control computers, robotic limbs, or other hardware with thoughts, primarily to restore function for people with paralysis or enhance capabilities in various fields like gaming, rehabilitation, and beyond. BCIs work by measuring brain activity (EEG), processing signals to interpret intent, and translating it into commands for an output device, with systems ranging from non-invasive headsets to implanted electrodes for clearer signals.



BCI is a promising technology witnessing rapid progress in recent years capable of directly using brain signals as a communication and control channel. This technology has great potential to play a critical role in neurological disease detection, prediction & rehabilitation. BCI is becoming a key component in the assistive technology and other applications field.

A Software with minimum features is designed and developed for analysing EEG data, EEG Microstate analysis, detection and Prediction of Epileptic Seizure disease.

In computing, an interface is a shared boundary or point of interaction where two different components, systems, or a user and a system exchange information, acting as a translator for communication, ranging from the physical ports connecting hardware (like USB) to the software elements (like buttons, icons) that let you control a device, making it user-friendly or enabling system-to-system communication. Touch/Gesture Interfaces: Swiping, tapping on screens or using hand movements.

How Do Detergents Remove Dirt Chemically?

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Detergents remove dirt mainly through a chemical process known as emulsification, which enables greasy and oily dirt to be removed using water. In everyday life, most stains and dirt present on clothes, utensils, and surfaces contain oil or grease. Since oil does not dissolve in water, washing with water alone is not effective. Detergents are chemical substances specially formulated to solve this problem and make cleaning possible.

A detergent molecule has a dual structure, which is the key to its cleaning action. One end of the molecule is called the hydrophilic head, which has a strong attraction to water. The other end is the hydrophobic tail, usually a long hydrocarbon chain, which repels water but has a strong attraction to oil, grease, and dirt. Because of this dual nature, detergent molecules can interact with both water and greasy dirt at the same time.

When detergent is added to water and applied to a dirty surface, the hydrophobic tails of the detergent molecules penetrate and attach themselves to the greasy dirt particles. At the same time, the hydrophilic heads remain in contact with water. During washing, rubbing, or stirring, many detergent molecules surround each dirt or grease particle. This arrangement leads to the formation of a structure called a micelle.

A micelle is a spherical cluster of detergent molecules in which the greasy dirt is trapped at the center. The hydrophobic tails point inward toward the grease, while the hydrophilic heads face outward into the surrounding water. This structure breaks large grease particles into smaller droplets and keeps them suspended in water. The process of breaking oil into tiny droplets and dispersing them in water is called emulsification. Because of emulsification, the dirt does not reattach to the fabric or surface.

Detergents also help in cleaning by reducing the surface tension of water. Normally, water has high surface tension, which prevents it from spreading easily and penetrating deep into fabric fibers. Detergents lower the surface tension, allowing water to spread more easily and reach the dirt trapped within fibers or pores. This increases the efficiency of washing and helps remove stubborn stains.

Another important advantage of detergents is that they work effectively in hard water. Hard water contains calcium and magnesium ions, which react with soap to form insoluble scum. Detergents, however, do not form such insoluble compounds and therefore remain effective even in hard water conditions.

In conclusion, detergents remove dirt chemically by combining several actions: their hydrophobic tails attach to greasy dirt, their hydrophilic heads interact with water, micelles are formed to trap dirt, and emulsification keeps the dirt suspended in water. Additionally, detergents reduce the surface tension of water, improving its cleaning ability. Through these chemical processes, detergents convert insoluble greasy dirt into water-dispersible particles, which can then be easily washed away during rinsing.

Internet of Things

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The Internet of Things (IoT) is a technology paradigm where everyday physical objects are connected to the internet so they can sense, process, and share data, often acting autonomously. It is reshaping how homes, cities, industries and healthcare systems operate by enabling smarter, data- driven decisions.

IoT describes networks of devices—such as sensors, appliances, vehicles, machines, and wearables—embedded with electronics, software and connectivity that allow them to collect and exchange data. These connected objects can monitor their environment, communicate with each other or cloud platforms, and trigger actions without constant human control.

An IoT system typically includes four **layers**: devices (sensors and actuators), connectivity, data processing, and applications that use the insights. Devices capture data, networks like Wi- Fi, cellular or LPWAN transport it, computing platforms analyze it and applications turn results into alerts, automation or reports.

SYNTHETIC MICROBIOLOGY

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Synthetic microbiology is a branch of science that combines engineering principles with microbiology to design, construct and reprogram microbial systems. The goal is to create microorganisms with new or improved functions—like producing medicines, biofuels or materials.While traditional microbiology observes and studies microbes, synthetic microbiology creates and redesigns biological parts and systems in a predictable, purposeful way. Genetic Engineering & CRISPR:Tools like CRISPR-Cas9 allow scientists to cut and edit DNA with unprecedented precision.Used to insert, delete or alter genes in microbes for desired traits. Standardized Biological Parts:Similar to how engineers use standardized components, scientists use genetic “parts” (promoters, sensors, switches) to build biological systems. Computational Design:Computers help model and simulate biological circuits before building them.Reduces trial-and-error in the lab. Applications of Synthetic Microbiology: Engineered microbes can:Fix nitrogen in soil to reduce chemical fertilizer use.Protect pants from pests by producing natural pesticides.Improve nutrient uptake for better crop yields.Biomanufacturing & MaterialsMicrobes can be designed to produce:Biofuels like ethanol or biodiesel Bioplastics and specialty polymersIndustrial enzymes for detergents and textiles. Medicine & Health:Microbes become factories for antibiotics, insulin, vaccines, and other pharmaceuticals.Engineering the microbiome (gut bacteria) could fight diseases like diabetes or cancer. Synthetic biosensors can detect disease markers.. Environmental CleanupSynthetic microbes can be programmed to degrade plastics, clean oil spills or capturharmful pollutants like heavy metals.They offer greener alternatives to chemical treatments.

Understanding Marine Biodegradation: Nature’s Underwater Clean-up

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The science of marine biodegradation presents a possible route toward a more sustainable future, despite the fact that plastic pollution is a well-known worldwide issue. Composting in your garden is far simpler than decomposing waste in the ocean.
The breakdown of organic materials by microorganisms (fungi, bacteria, and algae) that inhabit saltwater settings is known as marine biodegradation. Carbon dioxide and biomass are the final products of full biodegradation. A material's physical disintegration into tiny pieces (micro plastics). Polymer chains are broken down into smaller oligomers or monomers by the enzymes secreted by microorganisms. The microorganisms "eat" these smaller pieces, turning them into natural by-products and energy. In contrast to commercial composting, which accelerates decomposition by using high heat (about 58°C), for biodegradation the ocean is a "harsh" environment for a number of reasons. Because the majority of the ocean is cold, microbial metabolism is greatly slowed down. The deep water and bottom sediments are frequently oxygen-poor (anaerobic), necessitating distinct kinds of bacteria whereas the top is oxygen-rich (aerobic).Nitrogen and phosphorus are essential for microbes to flourish, yet they are scarce in many oceanic regions. The physical structure of materials and the effectiveness of enzymes can be changed by the intense pressure found in the deep sea. The process of marine biodegradation is not a "license to litter". Even the most biodegradable materials can still be consumed by birds or sea turtles while they require time to decompose. Instead, these materials are best used for items with a high risk of being lost at sea, such as Fishing gear and nets, Restoration tools (e.g., oyster reef binders).

Impact of Social Media Addiction on Society

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In today’s world social media has become a major part of people’s daily lives. While it connects us with others and provides useful information excessive use of social media has created a serious problem in society - social media addiction. Many people especially young students spend hours scrolling through social media platforms every day. This constant use affects their studies, health and social relationships.

One of the biggest effects of social media addiction is a decrease in attention and focus. Students often lose concentration in class because they are always thinking about their phones. Their academic performance suffers because they spend more time online than studying. Adults also experience similar problems when they spend too much time on social media instead of working productively.

Another major issue is mental health problems. Many people compare their lives with others based on posts and pictures they see online. This comparison leads to feelings of jealousy, low self-esteem, anxiety and depression. Instead of using social media in a positive way people begin to measure their self-worth by the number of likes and followers they have.

Social media addiction also affects real-life relationships. Families and friends often sit together yet remain glued to their phones. This reduces face-to-face communication and weakens emotional bonds. People may feel lonely and isolated even when they have hundreds of online friends.

Health problems are another result of excessive social media use. Long hours of screen time can cause eye strain, headaches, sleep problems and lack of physical activity. Many young people stay awake late at night checking updates which affects their sleep patterns and overall health.

Despite these challenges social media is not entirely bad. It has many positive uses such as spreading awareness, providing education and helping people stay connected. The real problem begins when people use social media without limits. To solve this issue individual must learn to use social media responsibly. Parents and teachers should guide children to balance their online time with studies, hobbies and physical activities. Schools can also organize awareness programs about healthy social media habits.

In conclusion social media addiction has become a major social problem in modern society. It affects education, health, relationships and mental peace. To build a healthier society it is important for people to control their use of social media and focus on real-life activities and relationships. With awareness and self-discipline social media can be used in a way that benefits society rather than harming it.

Hospital Administration: The Backbone of Efficient Healthcare Delivery

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Hospital administration is a vital component of the healthcare system that ensures hospitals function efficiently and deliver quality patient care. It involves planning, organizing, directing and controlling hospital resources such as manpower, finances, infrastructure and equipment. Effective hospital administration bridges the gap between medical services and patient satisfaction while ensuring compliance with legal and ethical standards. Hospital administration covers a wide range of activities essential for smooth hospital operations. These include policy formulation, human resource management, financial administration, procurement of medical supplies, maintenance of hospital infrastructure and coordination among departments. Administrators also oversee patient services, medical records, information systems and public relations. A hospital administrator plays a key leadership role by coordinating between doctors, nurses, paramedical staff and support services. Administrators are responsible for policy implementation, budgeting, accreditation standards, patient safety programs and legal compliance. They ensure optimal utilization of resources without compromising patient care. Hospital administrators face challenges such as rising healthcare costs, shortage of skilled manpower, increasing patient expectations, technological advancements and regulatory requirements. Managing emergencies, infection control, biomedical waste management and ethical issues further add to administrative complexity. Recent Trends in Hospital Administration Modern hospital administration emphasizes quality assurance, patient-centered care, hospital information systems, telemedicine, accreditation (NABH) and evidence-based management. This of digital health records and data analytics has significantly improved decision-making and efficiency.

The Natural Food Reality

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At its core, natural food refers to items that are minimally processed and free from synthetic additives, artificial flavours and chemical preservatives. While the term is frequently used in marketing, its true value lies in its nutrient density and the absence of industrial intervention.

Marketing vs. Regulation: Unlike "Organic," which has strict legal standards, the term "Natural" is loosely regulated in many countries. It generally implies that nothing synthetic has been added, but it doesn't guarantee how the food was grown (e.g., pesticides may still be used).The "Clean Label" Goal: The modern gold standard is a "clean label"-short ingredient lists composed of recognizable, whole-food items.

Nutrient Synergy: Natural foods provide vitamins and minerals in their original biological context. For example, the fiber in a whole apple slows sugar absorption, a benefit lost in "natural" apple juice. Disease Prevention: Diets high in unprocessed plants and animals are clinically linked to lower rates of chronic inflammation, Type 2 diabetes and heart disease.

Gut Health: Whole foods contain the prebiotics and natural fibers essential for a thriving microbiome, which regulates everything from immunity to mental health. A key takeaway is that not all processing is bad. The focus should be on avoiding Ultra-Processed Foods. Good Processing: Freezing vegetables (retains nutrients) or pasteurizing milk (safety).Harmful Processing: Altering food structures with industrial stabilizers, hydrogenated oils and high-fructose corn syrup to extend shelf life.

மனித நேயத்தை மையமாகக் கொண்ட ஒரு கதை.

மு.மகாலட்சுமி,
தமிழாய்வுத்துறை.

கடும் வெயில் அடிக்கும் மதிய நேரம். பேருந்து நிலையம் மனிதர்களால் நிரம்பி வழிந்தது. ஒவ்வொருவரும் தத்தம் கவலைகளில் மூழ்கி ஓடிக்கொண்டிருந்தனர். அந்தக் கூட்டத்தின் ஓரமாக, பழைய துணிகளில் மூடப்பட்டு, கையில் ஒரு சிறிய பையுடன் முதியவர் ஒருவர் அமர்ந்திருந்தார். உடல் தளர்ச்சி தெளிவாகத் தெரிந்தது; கண்களில் உதவி வேண்டிய ஏக்கம் இருந்தது.

பலர் அவரைக் கவனிக்காமல் சென்றனர். சிலர் பார்த்தும் பார்க்காதது போலத் தலையைக் குனித்தனர். அப்போது பள்ளி முடிந்து வீடு திரும்பிக்கொண்டிருந்த சிறுவன் கார்த்திக், அந்த முதியவரை பார்த்து நின்றான். “தாத்தா, உங்களுக்கு உடம்பு சரியில்லையா?” என்று அன்புடன் கேட்டான்.

முதியவர் மெதுவாகத் தலையாட்டினார். “காலை முதல் எதுவும் சாப்பிடவில்லை கண்ணா…” என்றார்.

கார்த்திக் தன் பையில் இருந்த சாப்பாட்டு பெட்டியை எடுத்தான். அது அவன் அம்மா அன்புடன் தயாரித்து வைத்த உணவு. ஒரு நொடி தயங்கினான். பிறகு சிரித்தபடி, “இதைச் சாப்பிடுங்கள் தாத்தா” என்று அவரிடம் நீட்டினான்.

முதியவரின் கண்களில் நீர் துளிர்த்தது. “உன்னைப் போல நல்ல மனம் கொண்ட பிள்ளைகள் இருக்கிற வரைக்கும் இந்த உலகம் அழியாது” என்றார். கார்த்திக் உணவைப் பகிர்ந்துக் கொடுத்ததோடு, அருகிலிருந்த கடையில் இருந்து தண்ணீரும் வாங்கிக் கொடுத்தான்.

அதைப் பார்த்த சிலர் நின்றனர். ஒருவர் ஆம்புலன்ஸ் அழைத்தார்; மற்றொருவர் முதியவரை மருத்துவமனைக்கு அழைத்துச் செல்ல உதவினார். சிறுவனின் ஒரு சிறிய கருணைச் செயலால், பலரின் மனம் மனித நேயத்தால் விழித்தது.

கார்த்திக் வீடு திரும்பும் போது பசி இருந்தது. ஆனால் மனம் நிறைவால் நிறைந்திருந்தது.

மனித நேயம் என்பது பெரிய செயல்களில் அல்ல; சிறிய அன்புச் செயல்களில் தான் உலகை மாற்றுகிறது.

கவிதை

மு.மகாலட்சுமி,
தமிழாய்வுத்துறை.

முள்ளின் நுனியிலும் ஆகாயம்

முள்ளின் நுனியிலும் ஆகாயம் விரிகிறது,
வலியின் நிழலிலும் வெளிச்சம் துளிர்க்கிறது.
காயம் கற்றுத்தரும் பாடம் மௌனமாய்,
காலம் கைகளில் நம்பிக்கை விதைக்கிறது.
காற்று கிழிக்கும் கனவுகளின் ஓரத்தில்,
கண்ணீர் கூட கண்ணாடி ஆகிறது.
விழுந்த இடம்தான் எழும் இடமென்று,
மண் நமக்கு மெத்தெனப் பேசுகிறது.
இருள் இறுக்கி அணைக்கும் நொடியில்,
நட்சத்திரம் தன்னை அறிமுகம் செய்கிறது.
துன்பம் தீட்டும் கோடுகளின் நடுவே,
தைரியம் தன் பெயரை எழுதுகிறது.
முட்கள் காயப்படுத்தும் போதெல்லாம்,
மலர்வதன் அர்த்தம் தெளிவாகிறது.
நம்பிக்கை நரம்புகளில் ஓடும் போது,
நெஞ்சம் நதி போல விரிகிறது.
தோல்வி ஒரு தற்காலிக முகவரி,
பயணம் நிரந்தர வீட்டைக் காண்கிறது.
உழைப்பின் வியர்வை முத்தமிடும்,
உதயம் கண்ணிமைக்கும் முன்.
மௌனம் கூட ஒரு மொழி தான்,
மனம் அதை கற்றுக் கொள்கிறது.
வானம் தொலைவில் இல்லை என்று,
வலி நமக்குச் சொல்கிறது.
சிறு பிளவுகளில் இருந்து,
பெரிய ஒளி பாய்கிறது.
ஒவ்வொரு முட்களும் ஒரு சவால்,
அதை தாண்டும் இதயம் ஒரு வானம்.
விழிகள் உயரம் தேடத் தொடங்கினால்,
விழுந்த பாதையும் உயரமாகிறது.
இன்று சுமந்த கற்கள் நாளை,
படிக்கட்டுகளாக மாறுகின்றன.
சிராய்ப்புகளின் வரலாற்றில்,
சிரிப்பின் எதிர்காலம் எழுதப்படுகிறது.
ஆகாயம் கைவரிசை அல்ல,
அது மனவிசாலம்.
முள்ளின் நுனியில் நின்றும்,
மனிதன் வானத்தை அளக்கிறான்.
நம்பிக்கை பெயரே வாழ்வு,
வாழ்வு பெயரே ஆகாயம்.

கல்வியின் அவசியம்

மு.மகாலட்சுமி,
தமிழாய்வுத்துறை.

அறியாமை இருளை அகற்றும்
அறிவின் ஒளியே கல்வி,
உயிர்க்கு உயிராய் துணைநிற்கும்
உன்னத வழியே கல்வி.
எழுத்தறிவு அல்ல கல்வி மட்டும்,
எண்ணத் தெளிவும் அதனுடன்,
நல்லொழுக்கம் நெஞ்சில் விதைக்கும்
நற்பண்பு பயிர் கல்வி.

ஏழைக்கும் அரசனுக்கும்

ஏகமாய் வழங்கும் செல்வம்,

கொள்ளையனாலும் களவாட முடியா

அழியா நிதியே கல்வி.

நாட்டை உயர்த்தும் சக்தியாக

நல்ல மனிதன் உருவாக,

சிந்தனை சிறகுகள் விரிக்கச் செய்யும்

சீரிய கருவி கல்வி.

இன்றைய விதை நாளைய பயிர்,

எதிர்காலத்தின் அடையாளம்,

வாழ்வை வளமாக மாற்றும்

வழிகாட்டி கல்வியே!

கல்வியை கற்போம்!

கற்ற வழியில் நடப்போம்!

வாழ்க்கையில் பின்பற்றுவோம்!