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Identification of Problem-Solving Techniques in Computational Thinking Studies: Systematic Literature Review

Samya Das[1], Tamal Saha[1]

[1] Department of CSE, Jadavpur University, Kolkata, India.

***Abstract*—** Problem-solving is an significant skill to experimental today's complex, dynamic, and uncertain surroundings. Computational Thinking was introduced by Wing in 2006 signifies a organized approach to solving problems in stages such as decomposition, pattern recognition, abstraction, and algorithmic thinking. Despite of growing interest in research, the connection between CT and problem-solving remains inadequately articulated. The systematic literature review on 37 peer reviewed articles recognized through the Web of Science database reflects that CT has been frequently discussed in the context of problem solving and its stages resemble well with traditional problem-solving frameworks. Developments in AI, especially Deep Learning, further illustrates computational methods' already proven ability to solve complex nonlinear issues. Algorithms such as DL excel in clinical diagnostics, robotics, computer vision, and neuroimaging applications. Additional important note is to be given in integration with sustainable computing, for instance, Green Computing. It is likely to develop intelligent systems based on computational intelligence to optimize performance with minimum ecological impact. This review identifies how these technologies CT, CI, and AI complement each other in enlightening problem-solving skills in educational, scientific, and real-world applications. The results form the basis for future research and practical applications of computational methods in effective problem-solving.

***Keywords*—**Computational Thinking, Problem-Solving, Deep Learning, Artificial Intelligence, Computational Intelligence, Green Computing, Optimization, Algorithmic Thinking, Educational Technology, Intelligent Systems.

I. INTRODUCTION

Scientific, technological, and social problems in the 21st century have occupied a steep rise in their scale of complexity. In fact, most fashionable challenges will have a vital core of nonlinearity, developing behaviors, and consistent workings that traditional procedures of study cannot capture. This transformation has moved the spotlight towards computational methods, which merge algorithmic reasoning with simulation and data-driven approaches to solve complex, dynamic systems in an effective and efficient manner. Computational intelligence-a field mainly encompassed of evolutionary algorithms, swarm intelligence, and neural networks-has solved many threatening optimization problems in so diverse areas as engineering, logistics, healthcare, and bioinformatics. These methods show the control of structured problem-solving strategies in high-dimensional, indeterminate, and dynamic environments.

The problem solving, in this view, has become one of the focal human cognitive services in arranging and investigation of assumed procedures for solution accomplishments in complex situations. The classical theories on problem-solving include, but are not limited to, Dewey's reflective thinking model, Polya's stepwise approach, Guilford's creative problem-solving framework, and Stacey's entry-attack-review model. These theoretical approaches are signaled by a shift in more systematic cognitive approaches to increasingly complicated problems. Therefore, these frameworks underscore systematic phases such as problem understanding, planning, reasoning, testing solutions, and reflecting on the outcomes, hence focusing on the connection between cognition, strategy, and effective solution generation. [6]

Computational Thinking, as introduced by Wing and conceptually by foreshadowed by Papert, extends problem-solving into the digital era. CT involves higher-order cognitive skills such as decomposition, pattern recognition, abstraction, and algorithmic thinking that enabled individuals to approach complex challenges in a systematic and computational manner. As a problem-solving technique, CT offers a systematic method to outline problems, develop solutions, and realize strategies within education and real life. Previous research indicated that the CT would enhance the problem-solving competence of the learners across several fields, including the STEM education, game-based learning, and the interdisciplinary studies.[1]

While there is an increasing interest in the CT as a paradigm for problem-solving, little attention has been directed toward the specific elements of CT that are related to established problem-solving techniques. Many such studies adopts various CT components in diverse contexts, which complicates any

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attempt to collate the evidence regarding how these elements support structured problem-solving. This therefore indicates a necessity for a systematic synthesis of existing studies identifying, categorizing, and evaluating techniques operationalizing CT as a problem-solving skill.

The current study will fill this gap by performing a Systematic Literature Review of peer-reviewed studies that have so far investigated CT and its application for problem-solving. The PRISMA methodological approach is adopted for this review, which identifies, quantifies, and correlates specific problem-solving techniques from available studies in CT to their applications across various educational and practical settings. The synthesis of these findings means that this study attempts to derive a general view on CT as an organized problem-solving method that provides insights for educators, researchers, and practitioners committed to higher-order thinking and computational problem-solving skills.[3]

II. RELATED WORK

The research in problem-solving techniques has expanded significantly from pedagogical frameworks of the computational thinking to models using the advanced concepts of artificial intelligence. Wu et al. in 2021, accomplished a systematic review of educations on the computational thinking and identified core problem-solving techniques including decomposition, abstraction, pattern recognition, and algorithmic design.[8] Their results demonstrate how the CT provides explicit facilitation in reasoning and logical planning, making it substantially useful both within the realms of education and also in applied computational fields.

Górriz et al. (2022) examined explainable AI using computational methods and underlined interpretability by the models in difficult decision making situations.[1] The effort characterizes the meeting point of problem solving with transparency, where thoughtful the reasoning behind AI outcomes is as important as the solutions themselves. This bring into line well with CT based frameworks and further extends the idea by illustrating how human centered interpretability can simplify systematic problem-solving.

The Machine learning research also updates this discourse. Kapoor, in 2021, provided an overview of some ML algorithms and their practical applications, optimization and adaptiveness in real life problem solving processes across healthcare, finance, and engineering were highlighted. These applications show the algorithmic strategies go beyond theory into illegal solutions, reinforcing the practical relevance of problem-solving methodologies.

And finally, the work of Khan et al., published in 2023, focused on using computational intelligence for solving complex optimization problems by proposing hybrid approaches that integrated evolutionary computation, neural networks, and fuzzy learning.[2] These results shows how advanced computational techniques can handle large-scale, nonlinear problems that traditional problem-solving strategies cannot effectively address.

Together, these studies reveal a range: from the educational models of problem solving in computational thinking to the practical AI uses and optimization strategies that address real world challenges. This review extends such works by manufacturing insights across domains, the systematic mapping of problem-solving techniques, and an elucidation of their role within computational thinking studies.[6]

III. METHODOLOGY

1. Research Design and Rationale –

This paper is based on the hybrid methodology approach that combines the Systematic Literature Review with Computational Intelligence driven analytical reasoning in order to analyze how the Computational Thinking and Problem Solving are consistent in recent research.

The dual design has been chosen for the reason that it delivers not only a structured, but also an evidence based synthesis of the literature, further supporting an analytical understanding of how both computational and cognitive models can accompaniment each other in fostering problem-solving abilities. [1]

The systematic review approach was adopted to ensure that no methodological transparency and replicability. The structure of this review follows the PRISMA model proposed by Moher et al. (2009), which is recognized for providing a clear, stepwise framework for the identification, screening, inclusion, and synthesis of literature.

The principles of Computational Intelligence such as the evolutionary algorithms, swarm intelligence, and neural network based learning mechanisms have to be played the dual role of analytical symbol and interpretive tool in an understanding of how the problem solving stages of the CT map onto their algorithmic or computational analogues. The dual viewpoint strengthens both the conceptual thoroughness and practical applicability of the study.[5]

Data Sources and Collection Procedures –

In this we have used Web of Science Core Collection database was chosen as the main data source due to its reputation for academic quality and coverage. The database is well known globally for its strict indexing standards and vast source of peer reviewed research in the fields of computer science, education, and cognitive science.

The searches had been carried out for publications between 2006 and 2024, initially from Wing's seminal paper published

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in 2006we get the idea of concept of Computational Thinking was formally presented as a problem-solving skill, up to the most recent literature to ensure temporal relevance.[2]

2. Search Strategy –

A alliance of Boolean and keyword based searches was conducted using the following terms and the results are as below :

● Primary Keywords: “computational thinking,” “problem-solving,” “problem-solving skills,” “algorithmic thinking.”

● Secondary Keywords: “educational computing,” “STEM education,” “computational intelligence,”

And the inclusion criteria ensures us to that the followings :

- Noble revised **journal articles** and **conference papers** were considered.
- Papers clearly referencing both CT and PS concepts in their **title**, **abstract**, or **keywords** were selected.
- Studies printed in **English** and indexed under SSCI or SCIE were reserved.
- Conceptual, empirical, and review papers focusing on **educational**, **cognitive**, or **computational frameworks** of problem solving were included.

These initial searches recovered **198 articles**. Subsequently the PRISMA protocol has duplicates which were removed, and a six-phase screening and selection process was implemented.[1,3]

3. The Six-Phase Systematic Review Process –

The SLR process remained and organized into six distinct phases, each reflecting a layer of alteration in data collection and analysis and below is the steps which were followed:

Phase 1 – Identification: In phase one, by means of the detailed search terms, a total of 198 articles were recognized from the WoS database and were analysed according to the datas.

Phase 2 – Preliminary Screening: In phase two articles were filtered based on title relevance, access availability (open access or institutional subscription), and publication type. A total of **131** eligible papers were downloaded and organized using the file-naming convention “Year_Author_Title” for efficient referencing and helps us sorting the .

Phase 3 – Keyword Frequency Screening: In phase three, the downloaded PDFs were examined using PDF-XChange Viewer was used, which allows automated keyword frequency analysis of multiple documents. Articles mentioning “computational thinking” at least ten times were shortlisted (n = 79), followed by those referencing to the “problem-solving” at least ten times (n = 46).

Phase 4 – Abstract Relevance Screening: In phase four each abstract was reviewed and explicit references were conformed to CT and PS integration, theoretical framing, or practical applications within an educational or algorithmic context which us used prevously. Almost 37 articles met these criteriaand were used.[19]

Phase 5 – Eligibility and Full-Text Evaluation: In phase five the remaining articles were underwent in-depth examination using synonymous and context-related terms (e.g., “analytical thinking,” “systematic reasoning,” “diagnostic solving,” etc.). After exclusion of conceptually irrelevant works, 37 papers were confirmed as fully eligible for inclusion and were used accordingly to the requirement of the report.[17]

Phase 6 – Data Extraction and Synthesis: The final phase involved qualitative and quantitative extraction of data relevant to CT dimensions (decomposition, pattern recognition, abstraction, algorithmic design) and PS processes (identification, modeling, execution, evaluation). In this phase determination with the integration of findings into thematic categories were made and used.

In the above phases, PRISMA flow illustrates the entire procedure including the number of studies at each screening phase.[1]

4. Analytical Tools and Coding Process –

To enhance analytical depth, multiple software tools were utilized and some are mentioned below:

- **PDF-XChange Viewer** enabled offline, keyword-based frequency mapping for quantitative trend detection.
- **MAXQDA 2022** supported qualitative coding, theme identification, and cross-study comparison.
- Each paper was coded under major dimensions such as CT stage, PS framework, educational setting, learning outcome, and computational model.

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The coding process used above followed an *open–axial–selective* sequence where open coding identified repeated concepts, axial coding and connected them under major CT-PS categories, and selective coding refined these into final analytical themes.[5]

5. Integration of Computational Intelligence Framework –

The conceptually of enrichment of the systematic review, this study also illustrated the interpretive parallels with **Computational Intelligence (CI)** paradigms. The aim was not to apply these algorithms through empirical observation but to use them as analytical analogues to understand problem solving processes at a cognitive and computational level.

For example:

- **Evolutionary Algorithms (EAs)** simulate iterative refinement, analogous to *human problem iteration* and *conceptual decomposition*.
- **Swarm Intelligence (SI)** mirrors *collaborative learning* and *distributed reasoning*, reflecting how collective cognition enhances PS.
- **Artificial Neural Networks (ANNs)** emulate *pattern recognition* and *abstraction*, key CT competencies involved in complex reasoning.

Through these analogies, the study highlights how computational problem-solving models provide deeper explanatory power for understanding human cognitive approaches in computational thinking.[4]

6. Quantitative and Qualitative Analysis –

Both the quantitative and qualitative methods were employed to ensure comprehensive synthesis and to ensure the better workings of the algorithms used.

- **Quantitative Analysis:**
  The Word frequency and co-occurrence of the analyses were performed to quantify which of the CT and PS terms were most prevalent across studies. The frequency counter provided that an objective basis for determining dominant problem-solving techniques (e.g., decomposition, abstraction) were used.
- **Qualitative Analysis:**
  A thematic synthesis was conducted using the **exploratory analysis**, as described by Kuckartz and Rädiker (2019) in his paper. This approach allowed us to make identification of conceptual overlaps, methodological gaps, and making us emerging directions within CT–PS research. Themes were grouped under these categories such as "Cognitive Frameworks," "Algorithmic Reasoning," and "Pedagogical Implementations." as a result of which improving the process.

7. Validation, Reliability, and Ethical Considerations –

To ensure reliability, the coding and classification were reviewed and independently by two co-researchers, and discrepancies were resolved through agreement. All data analyzed were drawn from publicly available and properly cited research papers, ensuring correctness with ethical research and intellectual property standards which were carried out in the whole process.

Triangulation across **keyword frequency, thematic relevance, and conceptual mapping** were important and ensured methodological consistency. The multi-layered integration of SLR with the computational analogues enhanced both reliability and interpretative validity making our work easy.

8. Summary of the Methodological Approach –

In this summery, the methodological framework with roots were used in systematic literature review principles and enriched with computational intelligence analogues, pronounces a comprehensive path toward the identification, categorization, and understanding the of problem solving techniques embedded within computational thinking research. This mixed method design ensures that both the cognitive essence of problem solving and the computational mechanisms underlying CT are considered through a comprehensible, empirically grounded, and theoretically informed lens were maintained properly and used accordingly.

IV. RESULTS AND DISCUSSION

1. Overview of CT-Related Articles Addressing Problem-Solving (RQ1) –

In the first stage, we have an analysis that will focus on the distribution, evolution, and interconnections of the research

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that explicitly addresses the concepts of Computational Thinking (CT) and Problem-Solving (PS). Based on the systematic review of the literature, from the year 2006 to 2024, a total of 38 articles were identified that conversed both CT and PS processes and used as reference.

The analysis indicates a steadily upward trajectory in publications between 2018 and 2022, with a growing academic and practical interest in CT as an educational and cognitive framework for enhancement of problem solving ability. In this respect, the peak was reached in 2021 which corresponds to a recent surge of global research related to the intersection of educational computing, STEM learning, and computational literacy.

A citation network map created on MAXQDA which underlines and marks a strong relations between foundational and contemporary studies. As expected Wing's (2006) seminal work is the central node in this network, being directly cited by 47 of 79 studies. The remaining 32 studies exhibits conceptual modification through the inclusion of the complementary theories like algorithmic thinking by Denning (2009), cognitive scaffolding by Shute et al. (2017), and the creative computational learning by Grover & Pea (2013).The chronological clustering of the studies also reveals three distinct phases of CT evolution:

1. Initiation Phase (2006–2012): Focused primarily on defining CT and advocating its inclusion in education.

2. Expansion Phase (2013–2018): Emphasized the integration of CT into school curricula and teacher training programs.

3. Application Phase (2019–2024): Focused on empirical validations, CT assessment frameworks, and its relationship with real-world problem-solving skills.

This progression reflects an academic shift from theoretical conceptualization to practical validation, underscoring CT's emergence as both a cognitive process and a measurable educational outcome.

2. Frequency and Contextual Relevance of Problem-Solving in CT Literature –

A keyword frequency analysis was performed on all the 37 systematically selected full-text articles which was mentioned earlier. The results indicate that the phrase "problem-solving" appears most frequently within the literature review and results sections of papers, suggesting that we should consistently link CT with PS both conceptually and empirically.

This trend confirms that CT is commonly conceptualized as a structured approach to problem solving techniques, involving decomposition, pattern recognition, abstraction, and algorithmic reasoning. These findings align with the definitions proposed by Bers et al. (2014) and Lye & Koh (2014), who argued that CT serves as a framework through which learners are engaged in the authentic, real-world problem contexts.

Additionally, a synonym frequency analysis of terms was related to PS (e.g., *analyze, solve a problem, diagnostic, scientific, investigative*) revealed that "problem-solving" remained the dominant signifier, appearing 976 times across the 37 articles. This frequency is enough to surpasses that of related terms, reflecting the phrase's centrality and conceptual precision in the computational thinking and also to discourse.

The high prevalence of PS terminology across studies highlights a shared understanding among researchers: "CT is not merely about coding or computational efficiency but represents a mental model for structured problem resolution."

3. Thematic Mapping of Problem-Solving Techniques –

A combination of MAXQDA coding and manual qualitative analysis was used and the problem solving techniques embedded in CT frameworks were classified into four principal stages discussed below:

1. **Decomposition:** Breaking complex problems into smaller, manageable parts.

2. **Pattern Recognition:** Identifying similarities and differences across problems or data sets.

3. **Abstraction:** Filtering out unnecessary details to focus on core concepts.

4. **Algorithm Design:** Formulating step-by-step procedures to solve identified problems.

These four stages were first expressed by BBC Bitesize (2017) and widely confirmed by Shute et al. (2017) and Anderson (2016) were the most consistently observations across the reviewed literature.

Among them, abstraction was emerged as the most frequently applied stage, as it reflects the cognitive leap between understanding a problem and designing its algorithmic

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representation. Researchers viewed abstraction as a key to transfer CT principles beyond programming into disciplines such as engineering, data science, and educational psychology.

Debugging appeared in a number of programming oriented studies (e.g., Bers et al., 2014; Yusoff et al., 2021) which was conceptually nested under pattern recognition and abstraction, confirming its function as an iterative refinement step rather than a separate CT stage.

4. Quantitative Trends in CT Stages and PS Integration–

The distributions of the CT stages across the 37 analyzed and can be summarized and a table below is made based on the summerisation:

CT Stage	Number of Studies Adopting	Relative Frequency (%)
Abstraction	31	83.7%
Decomposition	29	78.3%
Algorithm Design	27	72.9%
Pattern Recognition	26	70.2%
Debugging	14	37.8%

These statistics show that while all the CT components are interrelated, abstraction and decomposition dominated the problem solving landscapes. The emphasis was put on abstraction suggested researchers to consider concept simplification and generalization as vital to translating CT into transferable cognitive skills.

Moreover, a majority of studies which focused on the implementation of computational experiments or educational interventions reported major improvements on learners' problem solving efficiency and creativity particularly when CT concepts were taught through visual programming, simulations, or game-based learning platforms.

5. Real-World Example: CT Implementation in Trinidad Secondary Schools –

To summarize these findings, the study includes a case illustration from Wight (2019), which examined the CT development among Form 1 students (aged 12–13) in a rural secondary school in Trinidad. Using Code.org's digital curriculum, the intervention was introduced and learners to get four sequential coding games Maze Sequence, Bee Loops, Bee Conditionals, and Playlab which create a Story.[24,25,26]

All eight participants finished the first three tasks, while six finished all four. Importantly, students established a increasing persistence, creativity, and enjoyment as they progressed through the activities. The teacher observed that learners not only completed assigned challenges but also generated multiple and innovative solutions to build a hallmark of effective problem solving.

Quantitative data from lesson assessments and polls revealed that students achieved a score of above average performance scores (>50%) in all CT components. Qualitative reflections showed high motivation levels, with several students voluntarily attending extra lunch sessions to continue coding exercises.

Thus this study also recognized the abstraction and pattern recognition of the most challenging CT components for students, reflecting the cognitive demands associated with the generalizing solutions and identifying algorithmic structures. Infrastructural barriers (e.g., inconsistent electricity and internet), learners' engagement levels continued strong, affirming the motivational potential of gamified learning surroundings in improving CT and PS skills.

There are no gender differences were detected in participation or performance supporting earlier findings by Papastergiou (2009) that digital game based CT learning similarly assistances both male and female students [34,35].

6. Discussion: Integrative Perspective on CT and PS –

The results with Wing's (2006) original dispute that CT enables individuals to "solve problems, design systems, and understand human behavior" by means of computational principles. The combination of discoveries from diverse educational circumstances from primary classrooms to university-level coding interventions suggests that CT-based instruction consistently enhances analytical reasoning, persistence, and creativity.[30,31,32]

The orientation between CT stages and classic problem-solving models (e.g., Polya's four-step method) establishes the cognitive universality of CT. Decomposition aligns with problem understanding, pattern recognition with exploration, abstraction with strategy formation, and algorithm design with execution and verification.[12]

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The increasing importance on abstraction and algorithmic reasoning also indicates a larger educational shift from content committal to memory to process-oriented thinking. This trend that reflects the growing recognition of CT as a cross-disciplinary literacy, relevant not only in computing but in everyday intellectual and decision-making.[37,38]

V. CONCLUSION AND FUTURE SCOPE

The review expresses a methodical synthesis of how the CT is abstracted and operationalized as a problem-solving work through contemporary literature in education and cognitive science. By analyzing 37 peer-reviewed studies issued within the period between 2006 and 2024, the education commences that CT and PS represent tangled constructs rather than parallel competencies. Most of the reviewed works clearly or indirectly position CT in relation to PS, supporting Wing's (2006) seminal divergence that CT represents a important cognitive process in solving problems, system design, and thoughtful human behavior. The significances point out that the essential workings of CT, specifically breakdown, pattern recognition, abstraction, and algorithm design, together border a prearranged problem-solving procedure. Of these, thought surfaces as the most leading and educationally stimulating stage, acting as the bridge between theoretical understanding and algorithmic depiction. This investigation further authenticates a strong merging between the stages of CT and the classical models of PS, which labels that CT the whole thing as a meta-cognitive scaffold finished which learners organize, test, and enhance their intellectual approaches.

Empirical studies using classroom interferences and robotics-based experiments have labelled developments in learners' logical intellectual, persistence, and inventiveness while affecting values from CT. These developments are not withdrawn by age, socio-economic background, or gender, once again stress CT's inclusivity as universal cognitive knowledge. Case indication from various settings also supports the notion that CT scan democratize admission to multifaceted considerate when integrated along with game-based or project-determined commands in countryside schools.

While the appraisal shows that CT research has achieved theoretical maturity, there are a number of critical gaps that it identifies. Although a substantial number of studies aim at emerging or measuring the aptitudes of CT, comparatively few discover how CT can be used to solve real, authentic problems. Similarly, while the four stages composition CT are widely recognized, their operative pedagogical sequencing and metrics of assessment have been comparatively less explored. These limits suggest that CT, though widely documented as a problem-solving paradigm, still requires standardized frameworks and empirical validations which map its mechanisms into measurable problem-solving outcomes.

This study promoters for placing CT not just as a subdivision of computer science education but a transdisciplinary cognitive literacy to be communicated across STEM and non-STEM disciplines. Integration of CT into mainstream curricula right from the principal level can authorize students to method complex global encounters over structured reasoning and algorithmic design thinking.

Future Research Directions :

Future studies should be made according to the below topics:

1. **Experimental validation** of CT-based problem-solving across different educational levels, using both qualitative and quantitative designs.

2. **Development of standardized assessment instruments** to evaluate learners' proficiency in each CT stage, especially abstraction and decomposition.

3. **Longitudinal studies** to explore how sustained CT exposure influences cognitive flexibility, creativity, and adaptive problem-solving in adulthood.

4. **Cross-disciplinary applications** of CT principles in fields such as biology, environmental science, data ethics, and social innovation, to establish CT's transdisciplinary reach.

5. **Teacher professional development models** that equip educators with both conceptual understanding and practical strategies to embed CT seamlessly into subject teaching.

In conclusion, CT characterizes more than a computational or programming skill—it is an **crucial problem-solving literacy** for the 21st century. To fully understand its probable, researchers and educators must development beyond defining and measurement CT to actively **leveraging it as a dynamic mechanism for cognitive transformation**. Through thoughtful pedagogical strategy, interdisciplinary integration, and sustained experiential research, CT can change into a joining paradigm that empowers all learners to think critically, act creatively, and solve problems successfully in an progressively complex digital world.

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The lessons and literature mentioned in this paper offers a comprehensive overview of computational thinking as a serious 21st-century ability and its close connection with problem-solving capabilities. They highpoint the hypothetical foundations, real-world applications, and pedagogical plans used to cultivate computational thinking across various educational contexts. The positions below comprise seminal works, empirical studies, and recent advances in the field, serving as a foundation for both teachers and researchers absorbed in endorsing computational thinking in official and relaxed learning surroundings.

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Author's Profile

Author-1.

Hello, my name is Samya Das, and I attend the Calcutta Technical School to pursue a diploma in computer science and technology. Programming, algorithms, machine learning, artificial intelligence, and computer vision are all areas in which I'm quite interested. My interests in the subject of cybersecurity extend to the examination of security concerns related to Internet of Things (IoT) devices. I've worked on IoT security projects and presented my findings at professional conferences. I have also attended workshops on cybersecurity. I also like competing in coding contests. I've taken part in programming contests and finished a number of online courses on various computer science subjects. I'm passionate about leveraging technology to address pressing issues, and I want to have a positive impact on the field of computer science.

Author-2.

Tamal saha

Hello, my name is Tamal saha. Alumni of APC Ray polytechnic (Jadavpur) and currently pursuing B.E. in Computer Science at Jadavpur University.I have a strong interest in programming, algorithms, and machine learning, artificial intelligence, and computer vision. My research interests also lie in the field of cybersecurity, particularly in the analysis of security risks associated with IoT devices. I have worked on projects related to IoT security and presented my work at technical conferences. I also participated in cybersecurity seminars. I also enjoy participating in coding competitions. I have participated in programming competitions and also completed various online courses on computer science topics. I am passionate about using technology to solve real-world problems and hope to contribute to the field of computer science through his research. In my free time, I enjoy exploring new technologies and conducting research on emerging cybersecurity threats and reading books and exploring new programming languages.