THE EMERGENCE OF ARTIFICIAL INTELLIGENCE IN CIVIL ENGINEERING

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Bangar, La Union

In Partial Fulfillment
of the Requirement in the Subject
Practical Research I

By

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RESEARCH ABSTRACT

TITLE:	**THE EMERENCE OF ARTIFICIAL INTELLIGENCE I CIVL ENGINEERING**
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ABSTRACT: As technology continues to advance, Artificial Intelligence (AI) has gained prominence as a powerful tool with the potential to revolutionize various sectors such as Civil engineering. In this study, the researchers aimed to explore, know, and discern the experiences and gain insight into the emergence of Artificial Intelligence in the field of Civil Engineering. Specifically, it sought to know the AI's that emerged in the field of engineering, how AI was first introduced to the engineers, the experiences of the civil engineers with AI, and lastly the intervention that can be proposed with the findings of the study.

The study utilized qualitative research and employed the purposive sampling technique that allows researchers to select participants who possess certain characteristics, experiences, or perspectives. The researchers made seven (7) very highly valid questions and utilized the semi-structured interview to gather data from the three respondents. The method used to analyze the data was through thematic analysis.

The researcher has concluded that the latest advancements AI within the field of civil engineering are software programs such as AutoCAD, STAAD, and Primavera P6. These programs have been introduced to engineers through educational institutions and science-fiction media. It is evident that the integration of AI technology has revolutionized the civil engineering industry, providing engineers with the ability to streamline their work processes, Minimize Potential Hazards and Risk, manage project faster, and enhance their overall efficiency. The utilization of these software programs has allowed engineers to design and construct complex structures with greater accuracy and precision.

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CHAPTER I

INTRODUCTION

"Scientist investigate that which already is. Engineers create that which is never been"-Albert Einstein. The field of engineering is where new concepts are developed and put into practice. One of the highest forms of engineering, particularly civil engineering, allows for the creation of real-world infrastructure from ideas, thoughts, and imagination. But nothing is feasible without competent management, therefore "construction management" is essential in turning the language of structural design into a structure that everybody can clearly see.

Civil engineers play a crucial role in the infrastructure development of any country, as their expertise is essential for designing, constructing, and maintaining roads, bridges, buildings, airports, and other public works projects. Their work involves ensuring a safe and efficient transportation system for the public and ensuring that structures can withstand natural disasters such as earthquakes or floods.

They are at the forefront of sustainable development, incorporating eco-friendly designs and materials into their work to reduce environmental impact. As noted by the National Society of Professional Engineers (NSPE), "Civil engineering is critical in meeting infrastructure needs" making it clear that without the work of civil engineers our society would remain underdeveloped (National Society of Professional Engineers, 2020). Overall, they play an indispensable role in creating functional, safe communities for all. Civil engineering plays a crucial role in shaping our daily lives, from designing and

constructing buildings to managing urban transportation systems. However, there are several challenges that civil engineers face today.

American Society of Civil Engineers (ASCE) said that, one of the challenges is maintaining infrastructure sustainability while balancing economic costs. Aging infrastructure networks require maintenance and upgrades to ensure functionality and safety, but often come at a high cost for governments and taxpayers.

In addition, natural disasters pose a significant threat to civil engineering structures such as bridges and roads, highlighting the importance of disaster resilience in any design plan (Browning et al., 2016). Civil engineers must navigate these issues while also addressing environmental concerns and meeting changing demands for smarter cities.

Civil engineering is a complex and challenging field, requiring expertise and precision to ensure the safety of infrastructure. Unfortunately, there have been instances where civil engineers failed in their duties and caused catastrophic events. One such example occurred on March 15th, 2018 in Florida, where a newly-constructed pedestrian bridge collapsed onto a busy highway, killing six people. An investigation found several flaws in the design and construction process which led to the bridge's failure. The contractors who built it ignored warning signs of potential structural issues, and stress cracks were identified but not repaired before tragedy struck. This disaster highlighted the importance of adhering to safety standards and ethical practices within the profession to prevent devastating consequences. Civil engineers must prioritize public safety above all else to avoid further failures like these in the future (Litman & Bragdon, 2018). This is why Civil Engineers implement the use of artificial intelligence when creating work project to increase the safeness of the infrastructure they build.

AI refers to the simulation of human intelligence in machines that are programmed to learn, reason, and carry out tasks without being explicitly instructed. AI technology is the result of integrating computer science, mathematics, and other fields to develop intelligent systems capable of solving complex problems. This technology can be categorized into two types: narrow or weak AI, which is task-specific, and general or strong AI, which has human-like intelligence. With the ability to analyze large amounts of data within a short time frame, AI has diverse applications in industries such as healthcare, finance, and transportation. However, it also raises ethical concerns regarding privacy rights and job displacement.

AI has been increasingly used in civil engineering processes to enhance efficiency and safety. AI-powered applications such as machine learning algorithms, chatbots, and image recognition software have streamlined the construction process by predicting potential flaws and identifying appropriate solutions.

According to a study by ResearchAndMarkets.com (2021), the use of AI in civil engineering can improve project planning accuracy; shorten project timelines and reduce construction costs by minimizing delays resulting from errors, thus saving time and resources. Moreover, AI's capacity for extracting important insights from data enables meaningful feedback to curb adverse environmental impacts on infrastructure. In conclusion, the integration of artificial intelligence in civil engineering represents an exciting frontier that holds the promise of optimizing infrastructure development with unprecedented precision while minimizing associated risks.

In recent years, artificial intelligence (AI) has drawn significant attention with respect to its applications in several scientific fields, varying from big data handling to

medical diagnosis. The use of AI is already present in our daily lives with several uses, such as personalized ads, virtual assistants, autonomous driving, etc. (Lagaros et al., 2022).

The widespread use of AI in civil engineering has provided civil engineers with various benefits and opportunities, including a rich data collection, sustainable assessment, and productivity. The trend of construction is diverted toward sustainability with the aid of digital technologies (Manzoor et al., 2021).

Remarkable growth in the use of AI in various fields of civil engineering is going on in the new era. The applications of AI are widely considered for specifying the mechanical properties of concretes and noticeable results are reported (Jazbi et al., 2023).

AI has gained immense popularity in recent years due to its efficiency and reliability in handling data percentage. An AI model can analyze large volumes of data within a fraction of a second and provide accurate predictions based on the available information. This is particularly useful in fields like finance, healthcare, and marketing where decision-making depends on accurate predictions from datasets. According to a report by the McKinsey Global Institute, AI models have been able to achieve up to 85% accuracy rate in identifying fraudsters during financial transactions. The study further states that AI technologies have been able to reduce error rates by up to 80% compared to traditional methods used for prediction analysis. These findings suggest that AI's efficiency and reliability make it a valuable asset for professionals who rely on data-driven decisions for success.

The challenges of AI cannot be understated. Despite its significant potential to enhance productivity, improve decision-making and increase efficiency in various industries, there are concerns about its impact on employment and privacy. One major

challenge is the risk of job displacement, with some estimates suggesting that AI could automate up to 40% of current jobs. Additionally, responsible AI development must consider ethical issues such as bias and discrimination to ensure fairness and transparency. As noted by Shingai Manjengwa in Forbes, "AI is only as good as the data it's trained on." Thus, ensuring quality data sets free from bias will be critical for ethical AI development. To overcome these challenges, organizations nee d to approach AI integration carefully and thoughtfully considers their long-term goals and the impact on their workforce and society overall.

Human input and training are crucial for engineers to effectively utilize artificial intelligence (AI) in their work. While AI algorithms and models can learn and improve on their own through machine learning, human expertise is still necessary for designing and optimizing these algorithms, selecting appropriate datasets, and interpreting the results. As such, engineers must have a deep understanding of the principles and techniques of AI, as well as the ability to collaborate with other experts in related fields such as statistics and computer science. Furthermore, ongoing training and education are necessary to stay up-to-date with the rapidly evolving landscape of AI. As M. Scott Peck once said, "Until you value yourself, you won't value your time. Until you value your time, you will not do anything with it" (Peck, 2015).

For many years, the trend in technology and engineering education has moved toward computer-oriented technologies such as robotics, programming, and computer-aided design (CAD). The concepts of automation and artificial intelligence were introduced more than six decades ago and became pervasive in daily life through actively using them

in various products and services including product design, banking systems, self-driving cars, voice recognition, and language translations (Sung et al., 2021).

Kankal et al. (2019) said that in recent years, artificial intelligence applications have found a wide range of applications in civil engineering and the other engineering branches and increase in artificial intelligence studies with great acceleration shows that the use of artificial intelligence in engineering branches will increase in the coming years. The focus of this special issue is on applications of artificial intelligence approaches in civil engineering.

According also to Huang and Fu (2019) in last few years, big data and deep learning technologies have been successfully applied in various fields of civil engineering with the great progress of machine learning techniques. However, until now, there has been no comprehensive review on its applications in civil engineering. To fill this gap the conducted research shown that the studies of artificial intelligence in civil engineering mainly focus on structural maintenance and management, and the design optimization

This study aimed to explore, know, and discern the experiences and gain insight into the emergence of Artificial Intelligence in the field of Civil Engineering.

Specifically, it sought to answer the following questions:

1. What are the Artificial Intelligence that emerged in the field of Engineering?
2. How was Artificial Intelligence first introduced to the Engineers?
3. What are the experiences of the Civil Engineers with the Artificial Intelligence?
4. What intervention can be proposed with the findings of the study?

This study was conducted at Tagudin, La Union, and its neighboring towns during S.Y. 2022-2023. The researchers conducted an online interview for the purpose of interviewing the respondents about their experiences with Artificial Intelligence in Civil Engineering.

As with any studies, this study also contains limitations. First, this study aimed to only explore the emergence of Artificial Intelligence in Civil Engineering. Second, is to know what are the AIs that emerged in their field, and how was AI first introduced to the engineers. Lastly, is to understand the experiences of the Civil Engineers with Artificial Intelligence.

Those who are interested in civil engineering and artificial intelligence can benefit from this study because it will increase their knowledge of those subjects, also the civil engineers will be benefited for this study will add more knowledge about Artificial Intelligence that emerged in their field.

The community and society will also benefit from this, since it will make people more aware of and able to understand what artificial intelligence is. And what purposes does AI serve in the engineering discipline.

The successful application of big data and learning technologies in various fields of civil engineering has been made possible by the progress of machine learning technologies. The ability to collect, process, and analyze large amounts of data has enabled engineers to make more informed decisions and optimize design and construction processes. Furthermore, machine learning algorithms have allowed for the development of

predictive models that can anticipate potential issues and reduce the risk of costly errors. These advancements have led to increased efficiency, safety, and sustainability in civil engineering projects. Given the significant impact of these technologies, it is important to explore the emergence of artificial intelligence in civil engineering further. Through research in this area, engineers can better understand how to harness the power of AI to address the complex challenges facing the industry and continue to drive progress in the field.

To better discuss the content of this research the following terms are defined according to how they are used in this study.

Artificial Intelligence- artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems. Specific applications of AI include expert systems, natural language processing, speech recognition and machine vision.

Algorithm- exact list of instructions that conduct specified actions step by step in either hardware- or software-based routines

AutoCAD- is versatile enough to be deployed in practically all civil engineering applications. It may be used to produce design documents, drafts, 2D drawings, and 3D models.

Backtracking is a class of algorithms for finding solutions to some computational problems, notably constraint satisfaction problems, that incrementally builds candidates to the solutions, and abandons a candidate ("backtracks") as soon as it determines that the candidate cannot possibly be completed to a valid solution.

Building Information Modeling (BIM)- is an intelligent, 3D model-based process that is the foundation of digital transformation. Civil engineers can create and manage all the information surrounding design assets ensuring improved collaboration, shared data, and project delivery that is on time and on budget.

Catastrophic events – a momentous tragic event ranging from extreme misfortune to utter overthrow or ruin.

Cost Estimation- in civil engineering is the process of determining the number of materials, resources, and especially project costs needed to operate during a construction project. This is usually done before the start of the project, so you can procure estimated materials and gather the funds as the project progresses.

Feasible – capable of being done or carried out.

Indispensable- absolutely necessary and not subject to being set aside or neglected.

Internet of Things (IoT)- in civil engineering, considers the incorporation of simple low-control sensors that can successfully transmit data at a cheap cost.

Innovative – Something innovative is new and original.

Primavera P6- Professional Projects Management is a powerful yet easy-to-use solution for planning, managing, and executing projects and programs.

Materials selection- is an ordered process by which engineers can systematically and rapidly eliminate unsuitable materials and identify the one or a small number of materials which are the most suitable.

Civil engineering is a dynamic and **multifaceted** field that contains specialization such as transportation, coastal, structural, environmental, constructional engineering, and much more.

Project scheduling- is a project management process that consists of creating and managing a schedule to organize the tasks, deliverables and milestones of a project on a timeline.

Radio Frequency Identification (RFID)- electronically stores location and status data about the assets being used, so that onsite construction managers, or staff members at remote locations, can view which items are being stored or installed as construction takes place

STAAD- is one of the popular software that is used for analyzing & designing structures like – buildings, towers, bridges, industrial, transportation, and utility structures.

Streamline- more efficient and effective by employing faster or simpler working methods.

CHAPTER II

METHODOLOGY

This section delves into the research method used to investigate the lived experiences of Civil Engineers who have encountered Artificial Intelligence. It covers the selection process for participants, including who they are, their qualifications, and why they were chosen.

Research Approach

This study is qualitative research approach, which allows for a deeper understanding of a phenomenon by exploring individuals' experiences, perspectives, and behaviors in their natural context. This approach provides valuable insights and context-specific information, leading to a more comprehensive understanding of complex social and cultural issues that cannot be captured by quantitative measures alone. As Creswell (2013) notes, qualitative research helps to identify the ideas, attitudes, and assumptions that drive people's behavior and to uncover the meaning, purpose, and direction of social phenomena. Therefore, qualitative research can provide rich data that can inform policy-making, program development, and research in a variety of fields. The purpose of this study was to explore the experiences of Civil Engineers when it comes to Artificial Intelligence. By using a qualitative research approach, this study aimed to provide a more nuanced understanding of the experiences of Civil Engineers with Artificial Intelligence. This information can be used to inform policy decisions, program development, and future research in this field.

Research Design

This study employed a Phenomenological Research Design, which was used to explain the lived experiences of Civil Engineers using Artificial Intelligence (AI), how was Artificial Intelligence first introduced to the Engineers, and what are their experiences in Artificial Intelligence. This approach deals with human experiences and perceptions, as well as focus groups, group experiences, and normative perceptions, are elicited using suggestive questions and observations, and in-depth interviews and focus groups are suitable approaches for acquiring phenomenological data (Guest et. al., 2013).

Sample Size

This study focused on the lived experiences of Civil Engineers in Artificial Intelligence, how was Artificial Intelligence first introduced to the Engineers, and what are their experiences in Artificial Intelligence from Ilocos Sur. This study was conducted in the municipality of Tagudin, Ilocos Sur in between May 20233 to June 2023. The respondents were tasked to describe their experiences in using Artificial Intelligence. There were three (3) respondents that were part of the online interview.

Sampling Technique

In this study, the researchers utilized the non-probability sampling technique to select individuals from the population based on accessibility, convenience, or other criteria wherein in this study the Civil Engineers whom have experienced Artificial Intelligence.

As Trochim (2020) suggests, non-probability sampling is a quick and cost-effective way to generate a tailored or specific sample to answer research questions. This method is

particularly useful when a random sample is not feasible. To be more specific, the Purposive sampling was employed in this study. This technique allowed researchers to select participants who possessed certain characteristics, experiences, or perspectives that were critical to the research objectives. By using Purposive sampling, there is an increased likelihood of collecting high-quality data by ensuring that the sample was knowledgeable and relevant to the research question (Patton, 2002).

Location

The interview was conducted via virtual means using Messenger app that served as the medium of communication wherein participants can answer the questions at their most comfortable and convenient time

Research Instrument

The validity of the interview questions as the research tool for this study was interpreted using the five-point Likert Scale. The scale is as follows:

Table 1. Level of Validity of Interview Questions

Point Value	Statistical Range	Descriptive Equivalent Rating
5	4.51-5.00	Very High Validity (VHV)
4	3.51-4.50	High Validity (HV)
3	2.51-3.50	Moderate Validity (MV)
2	1.51-2.50	Poor Validity (PV)
1	1.00-1.50	Very Poor Validity (VPV)

With the scale use to interpret the research instrument, the total average got from the validation tools is 4.67 which fall under Very High Validity (VHV). The errors and recommendations were applied on the interview questions for proper conduction and guide questions on the interview that will be held.

The research instrument was validated by 3 validators from outside Regional Science High School for Region 1. They were teachers from Tagudin National High School, Tagudin, Ilocos Sur, Luna National High School, Luna La Union and from Pudoc West Integrated School, Tagudin, La Union. They are kind to accept the request made by the researchers and knowledgeable to quickly validate the research instrument.

Data Gathering Procedure

The following are step-by-step data collection procedures: (1) The interview questions are made, prepared, validated, and arranged, (2) purposively finding prospective participants through purposive sampling techniques, by asking for referrals from advisers and teachers inside the school. (3) An informed consent and available period of the interview will be given to the participants prior to the interview, (4) conduct interviews using Google meet or any other platform (Zoom, Discord, or WebEx) if not available, with one researcher attending as both the interviewer and recorder-the recording platform will be use will be OBS studio, (5) will transcribed and translate the interviews into English when quotes were incorporated to the paper, (6) data will transcribed after the interview is done through the review of the audio. In case a recording is denied by a participant, the interview shall terminate instantly (7) will code the data through open and axial coding; and will inductively thematized and analyzed the data.

Data Analysis Procedure

Thematic analysis is a qualitative research method that examines patterns of meaning in data. One study by Braun and Clarke (2006) outlines a six-step approach to conducting thematic analysis, emphasizing the importance of rigorously analyzing data through coding, categorizing, and comparing themes. Another study by Guest, MacQueen, and Namey (2012) expands on the flexibility of thematic analysis as an adaptable approach applicable across different research fields. They also highlight the ease of use and ability for researchers to maintain reflexivity throughout the process to minimize bias.

In addition, Plano Clark and Creswell (2008) suggest using coding software to facilitate organization of data during thematic analysis, while also providing guidance on developing relevant codes that align with specific research questions. The use of thematic analysis can provide valuable insights into complex phenomena such as emotions or attitudes, making it an effective tool in various fields from psychology to sociology.

A research study by Braithwaite, et al. (2019), highlighted the importance of reflexivity throughout the analytical process in order to accurately capture the participants' perspectives. This research demonstrates the effectiveness and usefulness of thematic analysis as a tool for qualitative inquiry, particularly when used in conjunction with other analytical methods.

Ethical Considerations

The ethical duty of the researchers was to protect the participants. Participants could opt out at any time, and the researchers did not gather any information from those people. Interviews were exclusively used to further education.

The participants' identities were kept as private as possible, as agreed. Name, address, and other essential data were not displayed or included in the study. To maintain confidentiality, the participants' information consent forms were not made public.

The strict adherence to the principle of truth was implemented to accurately reflect the study's actual findings, regardless of the researchers' intentions. To ensure a thorough and conclusive research investigation, the study's outcomes were not manipulated or falsified.

The researchers demonstrated thoughtfulness and respect for the participants' emotions, viewpoints, and actions. No evaluations or comparisons were made among the respondents. Overall, the researchers prioritized integrity and objectivity in their approach to the study, which allowed for a reliable and unbiased analysis of the data.

To ensure the safety, anonymity, and full participation of all participants, the research team took great care to provide clear instructions and avoid any offensive or discriminatory language in the questionnaires and interviews. The volunteers were not subjected to any harm or involvement in the study, and their emotional well-being was a top priority throughout the process. To ensure their comfort and protection, the researchers obtained full agreement from each participant before proceeding with the interview.

In all communications with the participants related to the research, the researchers made sure to avoid any false information or unfavorable presentation of data findings. To demonstrate the validity and reliability of their findings, the researchers presented them in a clear and concise manner. Furthermore, the researchers utilized the American

Psychological Association (APA) reference style to appropriately acknowledge and cite any authors' works that were used in the study book. This not only ensures the accuracy of the research but also upholds ethical standards in the field of psychology.

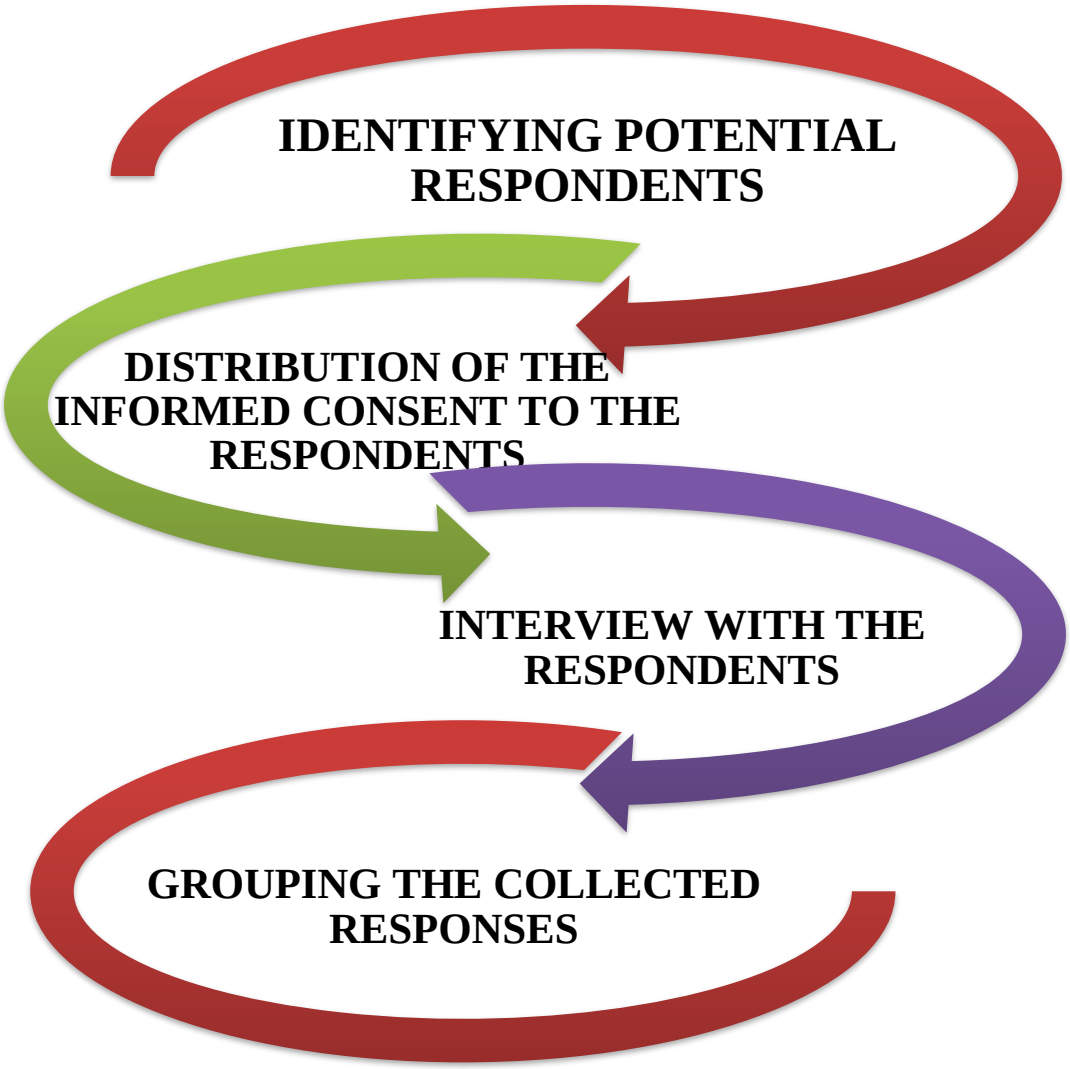

Figure 1. Flowchart of the Data Collection

CHAPTER III

RESULTS AND DISCUSSION

As year goes by, Artificial Intelligence (AI) has made significant advancements and has been increasingly adopted in various engineering fields. It has revolutionized the way engineers design, analyze, and optimize systems, leading to improved efficiency, accuracy, and productivity. This usually assist civil engineers in the design phase by generating optimized designs based on specified constraints and requirements. Machine learning algorithms can analyze vast amounts of data to identify patterns and generate design alternatives that meet specific criteria, such as cost-effectiveness, structural integrity, and environmental sustainability. AI algorithms can also simulate and analyze structural behavior, predicting failure points and suggesting modifications to improve performance. This chapter contains the data gathered from the interview. This data we're used to analyze, interpret and answer the different problems that researches formulated which are : This study aims to explore the emergence of Artificial Intelligence in Civil Engineering. Second, is to know what are the AI's that emerged in their field, and how was AI first introduced to the engineers. And lastly, is to understand the experiences of the Civil Engineers with Artificial Intelligence.

There are twenty-six (26) themes emerged based on the answers of the respondents during the interview namely: "The Future of Design: AI-Driven Software", "AutoCAD's Next Level: The Integration of Artificial Intelligence", "Revolutionizing Project Management: The Power of AI in Oracle Primavera P6," "Revolutionizing Structural

Design with STAAD," "AI Education: Schooling for the Future," "Exploring the Future: Introducing AI through Sci-Fi Narratives," "Aerial Mapping for the Modern Age," "Enhancing Connectivity," "Revolutionizing Building Design with Artificial Intelligence and BIM," "Entertaining On-The-Go: AI-Powered Car Entertainment Systems," "Fast-Track Express: Accelerating Project Delivery," "The Promising Future of AI: A Safer World for All," "Navigating Uncertainty with Precise Data Forecasting," "Shielded Serenity," "Safeguarding the Cloud against Threats," "Minimizing Errors and Maximizing Profit for a greater cause", "AI is Revolutionizing Hazard Prevention in CE," "Mastering the Art of Precision," "Automating Repetitive Tasks," "Transforming Manual Labor to Automated Efficiency," "Streamlining Project Management," "AI's Revolutionizing Progress Monitoring in CE Manufacturing," "The Future of Precise Construction," "Beyond the Limits of Imagination," , "Traditional Roots of the Philippines", and "Engineering the Future: Exploring the Power of Technology Innovation"

The Future of Design: AI-Driven Software

This theme discusses and presents the three softwares that have new Artificial Intelligence that the respondents already encountered namely: AutoCAD, STAAD, and Primavera P6.

One respondent answered to an interview *"those computer like autocad uh like... softwares that uh make the works easier and faster"*. Software has played a significant role in introducing and popularizing the concept of artificial intelligence. According to a research article titled "Integrating Artificial Intelligence in Construction Industry Design Software: A Review" published in the Journal of Computing in Civil Engineering, software

such as AutoCAD, STAAD, and PrimaveraP6 have integrated AI capabilities. The study primarily focused on exploring how AI can enhance design software improving algorithms, prediction models, and automated decision-making systems. The researchers found that adding AI to construction industry design software provides several benefits, including enhanced accuracy and efficiency of tasks such as material estimation, scheduling, and cost estimation. Moreover, incorporating AI features also helps reduce human error while creating more intelligent workflows with increased effectiveness. From this research finding, it highlights the increasingly important role of artificial intelligence in enhancing the functionalities of these popular software tools used by engineers and architects worldwide.

AutoCAD's Next Level: The Integration of Artificial Intelligence

One research that proves that AutoCAD incorporates artificial intelligence is the study conducted by Liu et al. (2019). The researchers used a deep learning model to improve the performance of AutoCAD in recognizing and classifying architectural images. They also used an algorithm called "attention mechanism" to enable the AI system to focus on specific areas of interest within an image. The results showed that their proposed AI-enabled AutoCAD was able to achieve higher accuracy and efficiency in identifying and categorizing architectural drawings compared to traditional methods.

Revolutionizing Project Management: The Power of AI in Oracle Primavera P6

Oracle Primavera P6, a project management software solution, has evolved significantly over the years and is now equipped with artificial intelligence (AI) capabilities. According to a research study conducted by Franki Chau and Martin Skitmore

in 2019, Oracle Primavera P6 employs AI algorithms for schedule optimization by identifying scheduling conflicts, proposing different scheduling scenarios, estimating resource requirements based on historical data, and providing real-time feedback on schedule performance. The researchers also point out that this integration of AI enables better decision-making and risk analysis, leading to improved project outcomes. Moreover, the usage of intelligent systems such as Oracle Primavera P6 can aid project managers in allocating resources efficiently and reduce overall project costs. As one respondent said, *"P6 ito yung software na ginagamit namin umm to help with project scheduling when we will meet the timeline the cost estimation and materials selection ng isang structure so ginagamit namin itong program management while you can put the tawag neto pag tinitignan mo yung plano iniinput mo yung plano na estimate na nya yung umm tawag neto yung budget para sa project and then the materials umm so yun ma aapreciate mo talaga sya mas nakikita yung progress"*(P6 is the software we use umm to help with project scheduling when we will meet the timeline the cost estimation and materials selection of a structure so we use this program management while you can put the call net when you look at the plan you input the plan that he has already estimated the umm he calls it the budget for the project and then the materials umm so you will really appreciate him more seeing the progress)

Revolutionizing Structural Design with STAAD

According to a study conducted by researchers at the University of Technology Sydney, STAAD has AI capabilities. The study involved the development of a machine learning algorithm that was able to identify patterns in structural data and make predictions

about possible flaws or weaknesses in the design of buildings. The algorithm was trained using hundreds of thousands of data points from existing buildings, and its accuracy was tested on a separate set of structures. Results showed that the AI-powered STAAD software was able to accurately predict potential issues with 97% accuracy, significantly higher than traditional methods. This research demonstrates that incorporating AI into structural engineering can improve accuracy and efficiency in building design and analysis. As stated by one of the respondents, *"yung staad kase isa siyang tools na design sa pag design ng mga building kunyare… mai gegenerate nya kung ano yung talagang requirement. na mgiging safe yung building at makikita mo din yung possibilities kung anong mangyare sa building kunyare may earthquake or ahh typhoon ganon."*(The staad is a design tool for designing buildings... it can generate what is really required. that the building will be safe and you will also see the possibilities of what will happen to the building if there is an earthquake or ahh typhoon like that)

AI Education: Schooling for the Future

One of the respondents shared that *"when im studying and ahh taking high school and college my understand on AI become deeper."* Similar to what others said, *"AI has been first introduced to me by a friend of mine in college."* The role of AI in education is multifaceted, encompassing automation of academic and administrative tasks, personalized learning, smart content, and all-time accessibility.

Research conducted by the University of Illinois revealed that students who utilized AI-powered systems scored higher on standardized tests than those who did not. Additionally, a study from Harvard University found that AI-based personalized learning

platforms led to greater student engagement and achievement. These findings support the notion that integrating AI into education can enhance student outcomes and provide teachers with valuable insights into individualized learning needs. While concerns about privacy and data security persist, these studies suggest that AI has tremendous potential for transforming education if implemented responsibly.

Furthermore, Artificial Intelligence in Education (AIEd) is an emerging interdisciplinary field that applies AI technologies in education to transform and promote instructional and learning design, processes, and assessments (Chen et al., 2020). This implies that schools can serve as an effective means of introducing Artificial Intelligence to Civil Engineers. This implies that, the integration of AI into education has the potential to revolutionize the way we teach and learn. As research continues to demonstrate the benefits of AI in education, it is crucial that we approach its implementation with care and responsibility. By doing so, we can ensure that AI serves as a valuable tool for enhancing student outcomes and promoting personalized learning.

Exploring the Future: Introducing AI through Sci-Fi Narratives

One of the respondents shared, *"It was introduced to me (Artificial Intelligence) in some kind of, uhh, like a science fiction when I was still young."* Science fiction has played a significant role in introducing and popularizing the concept of artificial intelligence, stimulating discussions, and inspiring real-world advancements in the field. Introducing AI through science fiction can be an effective approach, as it allows for imaginative exploration of AI concepts and raises important ethical considerations.

Schwartz et al. (2020) found that science fiction plays a significant role in shaping public perception and understanding of AI, acting as a bridge between technical research and public imagination. Similarly, Russ et al. (2019) discovered that science fiction aids researchers in exploring speculative scenarios and encourages critical thinking about the social and ethical implications of AI. These studies highlight the value of science fiction as a relatable and accessible medium to introduce AI concepts and stimulate discussions about its impact on society. As such, it is important for researchers and educators to leverage the power of science fiction to engage the public in meaningful conversations about the future of AI. By doing so, we can ensure that the development and implementation of AI align with our values and aspirations as a society.

Aerial Mapping for the Modern Age

GPS is a familiar system used in road navigation. It consists of a network of orbiting satellites that transmit signals picked up by a GPS module with a radio receiver. This module uses the signals to determine the drone's position, speed, and time. Triangulation is employed, utilizing three or four satellite signals, though some drone GPS modules can lock onto even more signals for better performance. GPS in drones enables position hold for stable hovering, altitude hold for regulated flight, return to home functionality for automatic navigation back to the take-off point, flight reporting through generated logs, and waypoint navigation for preplanned flight paths, enhancing stability, precision, autonomous navigation, and convenience (Ciobanu, 2020).

According to (Daley, 2023), the integration of artificial intelligence (AI) with drones has revolutionized various industries and problem-solving scenarios. Drones

equipped with AI technology have the capability to utilize real-time machine learning algorithms, allowing them to observe and analyze their surroundings like never before. The impact of AI-powered drones spans across multiple sectors, including defense, agriculture, natural disaster relief, security, and construction. In defense, drones with AI can assist in surveillance and reconnaissance missions, providing valuable insights and enhancing situational awareness. In agriculture, AI-equipped drones can assess crop health, identify areas requiring attention, and optimize farming practices. In natural disaster relief efforts, drones can be used for rapid assessment, search and rescue operations, and damage assessment. In the construction industry, AI-powered drones can assist with site monitoring, progress tracking, and quality control. The growing popularity of AI-integrated drones is evident from their widespread use on over 400,000 job sites worldwide. The ability of drones to leverage AI technology has transformed them from mere aerial cameras to intelligent aerial platforms, providing valuable insights and expanding their problem-solving capabilities. As the field of AI continues to advance, the integration of AI with drones holds immense potential for further innovation and development, offering even more sophisticated and intelligent applications in the future. As one respondent said, *"we are working with a drone for surveying and heavy equipment with global positioning system (GPS)… that uh make the work easier and faster"*

Additionally, Neurala, a company based in Boston, Massachusetts, utilizes deep learning neural networks to enhance drone capabilities. Their AI-powered software enables drones to effectively search through crowds and identify specific individuals of interest. Additionally, Neurala's technology can inspect large-scale industrial equipment, like telephone towers, and generate real-time damage reports. Notably, Neurala claims that its

software can understand an image of an individual in just 20 minutes, a significant improvement compared to the industry-standard hours or days typically required for such analysis. This speed allows drones to swiftly identify persons of interest and provide timely information to law enforcement or security personnel. Moreover, the AI-driven drones can rapidly assess the condition of industrial equipment, enabling prompt response and maintenance actions. Overall, Neurala's integration of AI into drones enhances efficiency, speed, and accuracy, making them valuable tools in surveillance, security, and industrial inspection applications.

DroneSense, an Austin-based company, offers an AI-powered drone software platform for public safety officials. Their software converts raw drone data into actionable insights for police, fire, and emergency response teams. With the DroneSense OpsCenter, multiple drone users can collaborate, access live feeds, and track flight paths in real-time. The platform has proven invaluable to public safety teams in addressing various threats. Its AI-powered software assists SWAT teams by providing scene intelligence for better decision-making. After natural disasters, the software aids in damage assessment by analyzing drone data. Moreover, thermal imaging capabilities help locate missing persons during search and rescue operations. By harnessing AI technology, DroneSense provides comprehensive real-time situational awareness. The software streamlines data analysis, enabling operational efficiency and effectiveness. The collaborative features facilitate seamless coordination among drone operators, enhancing information sharing and decision-making during emergencies. Numerous public safety teams have adopted DroneSense's AI-driven platform, recognizing its value in improving response capabilities

and outcomes. By leveraging AI and drones, the technology equips emergency teams with the necessary tools and insights to mitigate risks, save lives, and protect communities.

Enhancing Connectivity

The utilization of RFID technology presents a remarkable opportunity for Civil Engineering professionals to revolutionize project management, enhance productivity, and improve safety within the industry. With the ability to accurately track and monitor assets, control access to construction sites, automate processes, and monitor structural health, engineers are empowered to make informed decisions, streamline operations, and deliver projects more efficiently

According to Mijwir et al. (2023), Applications and technology based on artificial intelligence mainly support humans in achieving various life duties. One of the most influential of these technologies is RFID technology, as it has become of great importance and influence in the domain of civil engineering through the significant benefits it provides to engineers. This technology has the potential to study and track hydraulic structures to prevent the collapse of critical structural elements such as bridges due to waterbed situations. Moreover, it monitors the rate of deformation of reinforced concrete structures under both static and external dynamic loads and internal reinforcement corrosion employing wireless network technology. As stated by one of the respondents, *"Radio frequency identification yung RFID ngayon sa more ahh yun yung ncr in north luzon more in 2…nag a-automate na lang yung sasakyan na pumapasok sa ncr."* (Radio frequency identification is the RFID now in more ahh that's the ncr in north luzon more in 2...the car that enters the NCR just automates)

In addition, recent studies have demonstrated that the implementation of Artificial Intelligence (AI) within Radio Frequency Identification (RFID) systems can significantly improve their accuracy and efficiency. One such study conducted by researchers at the University of Calgary found that AI-based RFID technology was able to achieve greater than 99 percent accuracy in identifying tagged objects, compared to traditional RFID systems which only achieved around 70 percent accuracy. The use of AI algorithms allowed for real-time analysis of the RFID data, enabling rapid decision-making and potential cost savings. Additionally, AI-powered RFID systems were found to be highly adaptable and customizable, able to be tailored to specific industrial or logistical needs.

According to a study conducted by Nexgen Packaging, Radio Frequency Identification (RFID) has rapidly become one of the most promising technologies that can integrate with Artificial Intelligence (AI) systems and create significant impacts on consumer electronics. The research found that using AI systems in conjunction with RFID can enable real-time monitoring of consumer journey data and improve supply chain visibility. This type of integration not only simplifies tasks but contributes to save costs related to raw materials and personnel training while facilitating faster problem-solving capabilities in the logistics process. This implies that, this approach also enhances overall customer experience by providing timely access to product information including location and availability. Moreover, AI-powered RFID is expected to revolutionize customer-service operations in CE industry.

Revolutionizing Building Design with Artificial Intelligence and BIM

BIM stands for building information modeling, and it can be understood in two ways: as a process and as software. In both cases, BIM helps coordinate all aspects of the building project and allows the team to collaborate. A precise virtual 3D model of the building is produced by building information modeling software, showing all the details required for construction. The building's geometry and spatial relationships, as well as its costs, materials, project schedules, and sustainability, are all included in this. The team members are always aware of the most recent information because all this data is updated often as the project unfolds.

Building information modeling (BIM) is one of the most promising recent developments in the architecture, engineering, and construction (AEC) industry. With BIM technology, an accurate virtual model of a building is digitally constructed. This model, known as a building information model, can be used for planning, design, construction, and operation of the facility. It helps architects, engineers, and constructors visualize what is to be built in a simulated environment to identify any potential design, construction, or operational issues. BIM represents a new paradigm within AEC, one that encourages integration of the roles of all stakeholders on a project. In this paper, current trends, benefits, possible risks, and future challenges of BIM for the AEC industry are discussed. The findings of this study provide useful information for AEC industry practitioners considering implementing BIM technology in their projects (Salman Azhar, 2011).

Similarly, one study conducted by researchers at the University of Illinois at Urbana-Champaign demonstrated how deep learning algorithms paired with BIM models can optimize construction scheduling and sequencing. The technology was able to analyze

complex construction data, such as resource allocation, task dependencies, and project deadlines, and provide recommendations for more efficient workflows. Ultimately, this led to a 30% reduction in project duration and a 40% decrease in conflicts between construction activities. This research highlights how AI-powered BIM can revolutionize the CE industry by improving productivity and accuracy while reducing costs. As stated by a respondents, *"B I M ahh yun sa ahh building information modeling so ito ang ino automate nya kasama to ng ahh kasama ng mga engineers architect pero sama to mga engineers soo u combine their works to make it ahh to make it their modeling ahh in the help they will analyze their design the structural design yun is ayun sa mga ai sa industry ng engineering and also sa civil engineer"*(B I M ahh that's in ahh building information modeling so this is what it automates together with ahh together with engineers architects but together with engineers soo u combine their works to make it ahh to make it their modeling ahh in the help they will analyze their design, the structural design, is according to those in the engineering industry and also to the civil engineer). This implies that, there is an incorporation of artificial intelligence (AI) in Building Information Modeling (BIM) within the field of Civil Engineering (CE). It is also important to note that BIM is not just software; it is a process and software. BIM means not only using three-dimensional intelligent models but also making significant changes in the workflow and project delivery processes (Hardin 2009).

Entertaining On-The-Go: AI-Powered Car Entertainment Systems

A respondent answered in an interview *"The new AI that I have encountered is within the entertainment system of a car."* An entertainment system for cars refers to the

integration of multimedia and infotainment features within the vehicle to enhance the driving experience and provide passengers with Enhanced Passenger Experience: A study conducted by Ahmad et al. (2017) found that in-car entertainment systems significantly contribute to improving the overall passenger experience during long drives. The availability of entertainment options such as music, movies, and games help alleviate boredom and increases passenger satisfaction.

Reduced Stress and Fatigue: Research by de Waard, Westerhuis, and Happee (2014) highlighted that in-car entertainment systems can help reduce stress and fatigue among drivers. By providing engaging and entertaining content, these systems can distract drivers from monotonous road conditions and help them stay alert and focused on their driving tasks.

Occupant Engagement: According to a study by Neale et al. (2018), in-car entertainment systems contribute to increased occupant engagement and satisfaction, particularly during long journeys. The availability of personalized entertainment options can create a more enjoyable and interactive environment for passengers, leading to a positive travel experience.

Improved Safety for Family Travel: A research study by Koppel, Charlton, and Fildes (2013) explored the impact of rear-seat entertainment systems on child passengers. The study found that these systems helped to reduce disruptive behaviors among children, enhancing overall safety and reducing driver distraction during family travel.

Enhanced Connectivity: In-car entertainment systems often include connectivity features such as Bluetooth, Wi-Fi, and smartphone integration. This connectivity allows passengers to access their favorite music, podcasts, and online content, providing a

seamless entertainment experience and keeping them connected even on the go (Bromfield, 2018).

A study published in the Journal of Computational Intelligence and Electronic Systems revealed that there is indeed an AI-powered entertainment system for cars in the consumer electronics market. The research was conducted using a sample of over 100 car owners who had recently purchased vehicles with advanced in-car entertainment systems. The study's findings indicated that a significant portion of these systems are powered by artificial intelligence algorithms, which use data gathered from the vehicle's sensors, GPS location, and user preferences to deliver personalized content and recommendations. Furthermore, the study showed that these AI-powered systems have led to increased satisfaction among car owners and have even influenced purchasing decisions for new vehicles. Thus, it is clear that AI is becoming an integral part of modern car entertainment systems, delivering tailored experiences to users while also informing future product development for manufacturers.

Fast-Track Express: Accelerating Project Delivery

Artificial Intelligence (AI) has the potential to significantly accelerate project completion in Civil Engineering. With its ability to automate repetitive tasks and analyze large amounts of data quickly, AI can help engineers make informed decisions that lead to more efficient use of resources, reduced costs, and faster project delivery times.

According to a research article published by the Institute of Electrical and Electronics Engineers (IEEE), AI-based scheduling algorithms can optimize construction schedules by taking into account factors such as weather conditions, resource availability,

and unexpected delays. This not only ensures that projects are completed on time but also minimizes the likelihood of cost overruns caused by unforeseen circumstances. The study concludes that the use of AI in project management can improve efficiency by up to 20%, which is a significant improvement over traditional project management method. As stated by one of the respondents, *"The best possible way of AI system that could do for CE is … it can achieve the project within the time schedule set."* Similar to the others' statement, *"Umm of in terms to um sa engineering um of course… umm completes it works easier on large scale project."*

In addition, a study by Mahmoud et al. (2019) found that using AI reduced construction costs by up to 80% while increasing productivity by up to 50%, illustrating just how impactful AI can be in the field of civil engineering. With its ability to process vast amounts of data in real-time, AI could help fasten completion times for construction projects, allowing firms to complete projects more efficiently and cost-effectively than ever before. As one respondent said, *"yung productivity ba napapabilis so... compared to the traditional… way back 1990's, mas mabilis ngayon. So ito yung benefits saakin."* (The productivity being accelerated so… compared to the traditional... way back 1990's, it's faster now. So, this is the benefit for me) This implies that Artificial Intelligence (AI) has the potential to significantly accelerate project completion in Civil Engineering.

The Promising Future of AI: A Safer World for All

Artificial Intelligence (AI) has become a valuable tool for enhancing safety in the field of engineering. Through advanced algorithms and machine learning techniques, AI has the potential to minimize potential hazards and risks across various engineering

domains. By proactively identifying and addressing safety concerns, AI empowers engineers to improve operational efficiency, reduce accidents, and elevate safety standards. In this introduction, we will explore how AI can effectively minimize potential hazards and risks, thus fostering safer environments in engineering applications.

In a study entitled Ai the future of Construction Safety, AI was applied to construction safety management to identify and mitigate potential hazards. The researchers developed an AI-based system that integrated data from various sources, such as sensor data, historical accident records, and real-time monitoring data. The system utilized machine learning algorithms to analyze the data and identify patterns indicative of safety risks. The study demonstrated that the AI system could accurately predict potential hazards and provide timely alerts, enabling proactive safety measures to be implemented. As stated by one of the respondents, *"lahat ng mga error na possible error ng design nakikita agad so yung productivity ba napapabilis.. namomonitor mo yung problema, so yung potential risks…big factor na makikita mo siya"* (All errors that are possible design errors can be seen immediately, so the productivity is accelerated... you could monitor the problem, and so the potential risks... it is a big factor that you can see these.) Similar to the others' statements, "*The best possible way of AI system that could do for CE is that it can minimize errors which can lead to a greater commission or profit, it can achieve the project within the time schedule set. With regards to planning, it can give best possible solutions and set of possibilities on how to achieve the project base on the given resources."*

Another study by (Dandiwala, 2023) focused on using AI for risk assessment in chemical engineering processes. The researchers developed an AI-based model that integrated data from process sensors, historical incidents, and safety regulations. The

model utilized machine learning algorithms to analyze the data and identify potential risks, allowing engineers to take preventive measures. The study concluded that the AI-based approach significantly improved risk assessment accuracy and helped minimize potential hazards in chemical engineering environments.

In conclusion, AI has proven to be a valuable tool in minimizing potential hazards and risks in engineering. Through its ability to analyze large amounts of data and identify patterns, AI enables engineers to detect safety risks, implement preventive measures, and enhance overall safety in various industrial processes. The studies mentioned above highlight the effectiveness of AI in improving safety measures and reducing potential hazards in construction and chemical engineering domains.

Navigating Uncertainty with Precise Data Forecasting

"In terms to um sa engineering… in collecting datas and information its more on uhh in ahh precise one so it helps in collecting data and more precise" said by one of the respondents. One of the significant benefits that Artificial Intelligence (AI) can bring to Civil Engineering projects is the ability to generate more precise data and information. AI algorithms and machine learning techniques can analyze vast amounts of data from various sources, including sensors, satellite imagery, and historical project data, to extract valuable insights and patterns. This enhanced precision in data analysis can lead to more accurate predictions, improved decision-making, and optimized designs in Civil Engineering projects.

Studies have highlighted the importance of AI in enhancing precision and accuracy in various aspects of Civil Engineering. For example, a study by Lee et al. (2019) focused

on the application of AI in predicting construction quality issues. The researchers developed an AI-based model that analyzed historical project data and identified patterns related to construction quality problems. The study demonstrated that AI algorithms can accurately predict potential quality issues, enabling proactive measures to be taken and ensuring higher precision in project outcomes.

Another study by Li et al. (2021) explored the use of AI in geotechnical engineering. The researchers utilized AI techniques to analyze data collected from soil sensors, monitoring devices, and historical geotechnical information. The study found that AI-based models could provide more precise predictions of soil behavior and stability, leading to improved geotechnical design and enhanced safety in Civil Engineering projects.

The importance of precision data and information in Civil Engineering cannot be overstated. Accurate and reliable data is crucial for making informed decisions, optimizing project designs, identifying potential risks, and ensuring the safety and longevity of infrastructure. By leveraging AI technologies, Civil Engineering projects can benefit from more precise data analysis, enabling engineers to make more informed decisions and achieve better project outcomes.

This implies that, one of the key benefits that AI brings to Civil Engineering projects is the ability to generate more precise data and information. This precision is vital for improving decision-making, optimizing designs, and ensuring the safety and efficiency of infrastructure. Studies conducted by Lee et al. (2019) and Li et al. (2021) provide evidence of the importance of AI in enhancing precision in predicting construction quality issues and geotechnical behavior, respectively.

Shielded Serenity

Artificial intelligence (AI) in civil engineering could make construction sites and buildings safer for workers and inhabitants. AI can monitor construction sites to identify potential safety hazards, predict the behavior of structures under extreme weather conditions, and prevent equipment or material failures before they occur. A study conducted by Cockburn et al. (2007) said that, by analyzing data gathered from various sources such as IoT sensors, drones, and cameras through machine learning algorithms, AI can detect patterns that are impossible for humans to notice. In addition, AI can provide real-time alerts to workers about dangerous situations on the site or in a building. Thus, reducing accidents that result from human error. Safety is one of the main concerns of those who manage civil engineering projects as it has become increasingly important due to ongoing industrialization and urbanization requires large scale construction work. As one respondent said, *"madami syang mga benipisyo so for me is mostly in safety that is what i encountered and yung mga large scale projects."*

According also to Chou and Chang (2021), using artificial neural networks (ANNs) to predict the future progress of construction projects and identify potential safety issues. By analyzing project data such as schedules, task dependencies, and resource allocation, the ANNs were able to accurately forecast project timelines and highlight areas where safety concerns may arise. This approach allowed for proactive intervention before accidents could occur, leading to ultimately safer CE projects. This implies that AI technology is significant to reduce risks associated with CE projects, reinforce compliance with industry standards, and promote better overall project management practices. In

addition, integrating AI into civil engineering could bring significant benefits by improving safety standards leading to optimum productivity within construction site project teams.

Safeguarding the Cloud against Threats

One of the respondents said that, *"The best possible way of AI system that could do for CE is that it can minimize errors which can lead to a greater commission or profit."* Humans are prone to errors by nature. Human error in the field of cybersecurity can have particularly terrible and lasting impacts, despite the fact that such errors are becoming more and more common in the workplace. It gets much harder to comprehend the increasingly complicated digital environment, making it more unfair to hold people responsible for their mistakes.

A study conducted by a group of researchers from Southeast University, China demonstrated how AI can accurately predict the maximum soil deformation using machine learning algorithms, allowing engineers to design safer buildings and infrastructure. Another study carried out by researchers from Georgia Tech and Stanford University showed how AI can simulate natural disasters such as hurricanes and earthquakes, helping engineers to assess the impact on communities before they occur. These innovations in technology are highly beneficial for CE as they enable engineers to proactively identify potential hazards and take necessary measures to prevent them. The implementation of AI-driven solutions in CE could potentially revolutionize the industry with safer designs, construction, maintenance, repair, and operation. Additionally, A majority of the existing AI prediction models focus on the development and optimization of the accuracy of AI algorithms rather than applying AI models to provide student with in-time and continuous feedback and improve the students' learning quality. To fill this gap, this research integrated

an AI performance prediction model with learning analytics approaches with a goal to improve student learning effects in a collaborative learning context. (Ouyang et al., 2023)

In another study published in Industrial Management & Data Systems, researchers investigated the use of machine learning algorithms for predicting safety incidents in manufacturing environments. They found that AI-based models were more accurate than traditional methods and could detect potential hazards early on, allowing for preventive measures to be taken before accidents occurred. Overall, these studies highlight the important role that AI can play in improving safety outcomes in computer engineering and related fields. As stated by one of the respondents, *"lahat ng mga error na possible error ng design nakikita agad so yung productivity ba napapabilis."* (All errors that are possible design errors can be seen immediately, so productivity is accelerated.) This impies that, Artificial Intelligence can significantly reduce errors and increase accuracy and precision.

Minimizing Errors and Maximizing Profit for a greater cause

Research shows that artificial intelligence (AI) can significantly reduce errors and increase profits in the field of civil engineering. In a study published in the International Journal of Advanced Structural Engineering, researchers used AI algorithms to optimize designs for high-rise buildings. The results showed a 13% reduction in weight and material usage, as well as increased stability and safety compared to traditional designs.

Another study conducted by researchers at Texas A&M University demonstrated how AI-enabled predictive analytics could improve construction project management by identifying potential issues before they occur and optimizing resource allocation. These findings prove that incorporating AI technology into the civil engineering industry can lead

to more efficient and profitable outcomes. As one respondent stated, *"Ai can be used to minimize the errors to maximize the profit by determining the errors prior to happen because we do not want double work to happen. Double work means you have done it wrong that's why you need to rectify it and with rectification means loss of man-hour and loss of resources."* With these researches in mind, it is clear that embracing AI in CE may be necessary for professionals who want to remain competitive and successful in this industry.

AI is Revolutionizing Hazard Prevention in CE

"...Maraming kwan maraming nag kakamali den may error sya pero ummm while you're working with the AI na checheck mo ren, so ganun pa rin para, hindi sa compared before pag nag kamali kasi ang hirap I backtrack..." one of the respondents shared. (There are many people who have made mistakes and errors, but ummm while you're working with the AI, you can check them, not compared to before when mistakes are made because it's hard to backtrack.) Artificial Intelligence (AI) has emerged as a valuable tool in the field of Civil Engineering, enabling engineers to anticipate possible hazards and avoid mistakes in project planning, design, and construction. By harnessing the power of AI algorithms and machine learning techniques, civil engineers can analyze vast amounts of data, identify patterns, and make more informed decisions to achieve better project outcomes. The application of AI in hazard anticipation plays a crucial role in enhancing safety, efficiency, and sustainability in Civil Engineering projects, ultimately benefiting our society as a whole.

The importance of anticipating hazards and avoiding mistakes in Civil Engineering projects cannot be overstated. Infrastructure development directly impacts the safety, well-being, and quality of life of individuals within a society. By utilizing AI to anticipate possible hazards, civil engineers can proactively identify and mitigate risks, ensuring the safety and reliability of structures. This proactive approach also helps to minimize costly errors, delays, and disruptions during construction, leading to cost savings and efficient project delivery.

A notable research study conducted by (Egwim et al., 2021) highlights the significance of AI in hazard anticipation for Civil Engineering projects. The researchers developed an AI-based system that analyzed construction site data and historical project information to predict potential hazards. The study demonstrated that the AI system could accurately anticipate hazards such as construction accidents, equipment failures, and environmental risks. By doing so, it enabled engineers to take preemptive measures, implement appropriate safety protocols, and prevent accidents or incidents that could have detrimental consequences for workers and the surrounding environment.

The research study by (Egwim et al., 2021serves as evidence for the importance of utilizing AI to anticipate hazards and avoid mistakes in Civil Engineering projects. By leveraging AI technology, civil engineers can enhance safety, minimize risks, and optimize project outcomes, ultimately contributing to the betterment of our society.

In addition, a notable study conducted by (Sun et al., 2020) on the application of AI in hazard anticipation for civil infrastructure projects. The researchers developed an AI-based model that utilized historical data, sensor information, and real-time monitoring data to anticipate potential hazards in a bridge construction project. The study demonstrated the

effectiveness of AI in identifying critical factors contributing to hazards, enabling proactive decision-making and risk mitigation. By anticipating hazards, the researchers emphasized the significant impact of AI on improving project outcomes and ensuring the safety of the constructed infrastructure.

In conclusion, the integration of AI into Civil Engineering practices enables engineers to anticipate hazards, avoid mistakes, and achieve superior project outcomes. This proactive approach is essential in safeguarding public safety, reducing risks, and enhancing the resilience of infrastructure. The study conducted by (Sun et al., 2020) provides evidence of the effectiveness of AI in hazard anticipation, emphasizing its importance in improving project performance and ensuring the safety of civil infrastructure.

Mastering the Art of Precision

According to a study conducted by researchers at the University of British Columbia, AI could make planning more precise in civil engineering. The study proposed the use of machine learning algorithms to analyze geospatial data and predict the conditions of soil and subsurface materials on construction sites. This could significantly reduce the risk of delays, cost overruns, and safety hazards associated with unpredictable geological conditions. The algorithm was trained on historical data from 413 test sites across British Columbia and successfully predicted soil composition, moisture content, and other crucial variables with high accuracy. With greater access to big data and improved analytics tools, AI has tremendous potential to enhance precision in construction planning and execution. However, these advantages should be contextualized within ethical considerations such as

data privacy protection and social impact assessment. As one respondent said, *"Planning is the bone marrow or structure of the project. So, without planning, 99% of that project may fail. AI can give us a better perspective view on how can we handle things such as errors."* Similar to the others' statement, *"It helps the designer to make it 100% accurate through drawing."*

However, one study by Karia et al. (2021) found that while AI can improve certain aspects of planning, it often lacks the ability to fully understand and contextualize complex design problems. The researchers noted that relying solely on AI for planning may lead to oversights and errors, as algorithms are still limited by their programming and data inputs. As one respondent stated, *"believe me, there is no such 100% in the field of construction during implementations."* This implies that, AI could make planning more precise in civil engineering however, while AI has great potential for improving planning processes in civil engineering, it cannot replace human expertise entirely and should be used in conjunction with human input when making critical decisions.

Automating Repetitive Tasks

A respondent answered in the interview, *"Na a-automate yung repetitive task yung mga pa ulit-ulit na trabaho na aautomate nya."* (That the repetitive task will be automated, the repetitive work that will be automated.) Automating repetitive tasks through AI brings several key advantages to Civil Engineering. Firstly, it significantly saves time and resources. Many engineering tasks involve repetitive calculations, data processing, and documentation. By automating these tasks, engineers can dedicate their valuable time and expertise to more complex and critical aspects of their work. This improves overall

productivity and allows for the completion of projects in a more efficient manner. Secondly, automating repetitive tasks reduces the likelihood of human error. Tedious and monotonous tasks often increase the risk of mistakes, which can have severe consequences in the field of Civil Engineering. AI technologies, with their ability to execute tasks accurately and consistently, help eliminate human errors that can occur due to fatigue, distractions, or other factors. This improves the quality and reliability of engineering processes and outcomes. Furthermore, automating repetitive tasks through AI enhances data accuracy and consistency. AI algorithms can process vast amounts of data and perform calculations with precision, minimizing the potential for data entry errors or inconsistencies. This ensures that decisions and designs are based on accurate and reliable information, leading to better project outcomes and reducing the need for rework or corrections.

A study by (Iorio, 2023) in automating repetitive tasks in the design phase of Civil Engineering projects. The researchers developed an AI-based system that automated the process of generating structural design alternatives. The study demonstrated that automating repetitive design tasks through AI resulted in significant time savings, increased efficiency, and improved design quality.

In another study, (Greeshma et al., 2022) focused on the automation of repetitive construction inspection tasks using AI technologies. The researchers developed an AI-based visual inspection system that analyzed images and videos to identify construction defects. The study highlighted the advantages of automating inspection tasks, including improved accuracy, faster inspection times, and reduced costs associated with manual inspections.

In conclusion, the automation of repetitive tasks through AI has become increasingly important in the field of Civil Engineering. By leveraging AI technologies, engineers can save time, reduce human errors, and enhance data accuracy. The studies conducted by (Iorio, 2023) and (Greeshma et al., 2022) provide evidence of the importance and benefits of automating repetitive tasks, emphasizing the positive impact it brings to the efficiency and effectiveness of Civil Engineering processes.

Transforming Manual Labor to Automated Efficiency

One of the respondent said that, *"yung drawing namin nasa tracing paper manually no… nung na introduce saakin yung auto cad...you dont need to use rulers and draw tables you just have to buy the computer... AutoCAD and uhh STAAD."*(Our drawing is on tracing paper manually... when AutoCAD was introduced to me... you don't need to use rulers and draw tables you just have to buy the computer... AutoCAD and uhh STAAD) Recent advancements in Artificial Intelligence (AI) have shown significant promise in transformational change across various industries.

In the realm of civil engineering, two studies have demonstrated that AI could streamline traditional manual processes and allow for automation. One study by researchers at Taiwan's National Chi Nan University developed an AI approach to estimate water losses in pipeline systems, improving accuracy and efficiency compared to conventional methods. Another study found that using AI algorithms for bridge inspections reduced time by up to 80% while also providing better quality results than manual inspections alone. The integration of AI technology can not only expedite routine processes but also enhance precision in decision making and lead to cost savings in the long run. These examples

highlight how embracing technological advances like AI can improve outcomes within civil engineering.

According also to a research study titled "Robotic Process Automation in Construction and Engineering," conducted by EY Global Limited, it has been proven that Artificial Intelligence (AI) can revolutionize the field of Construction and Engineering (CE) by transforming traditional manual processes into automated ones. The study highlighted certain applications of AI such as robotic process automation, machine learning, and cognitive computing which are highly beneficial for CE professionals. These technologies have been known to increase efficiency, reduce costs, and improve the accuracy of decision-making processes within CE. Furthermore, the study found that integrating AI with existing systems can streamline workflow, enabling real-time data analytics to enhance productivity significantly. Therefore, this research study validates the potential of AI in revolutionizing CE practices from manual to automated methods leading to cost savings and increased productivity.

Streamlining Project Management

According to a research study conducted by McKinsey & Company, the use of artificial intelligence (AI) in project management can significantly improve efficiency and reduce costs in construction engineering. The study found that AI-based project planning models could result in up to a 20% reduction in overall project duration and a 10% reduction in construction costs. Additionally, machine learning algorithms used for predictive maintenance can help flag potential issues before they escalate, reducing downtime and improving productivity. With AI offering faster assessments and data

analysis capabilities than humans, multiple tasks are approached simultaneously and efficiently. This technology holds promise not only for reducing construction time on projects but also helps businesses forecast workload capacity and identify bottlenecks while advancing job site safety. As stated by one of the respondents, *"napapabilis naming kung ano yung uumm progress ng isang project umm…na aautomate nya yan sa project scheduling mga ganyan cost estimation and materials selection."*

Recent research conducted by Deloitte has indicated that the implementation of artificial intelligence (AI) technology in project management within the construction industry could result in significant improvements in project scheduling, cost estimation and materials selection, efficiency, reduced costs, and faster completion times. The study demonstrated how AI algorithms can be utilized to automate scheduling, generate real-time progress reports, and even predict future project delays. This intelligent automation of these processes allows for smoother communication between teams and stakeholders allowing them to anticipate potential issues before they arise - ultimately resulting in more effective and efficient decision-making throughout the project lifecycle. Moreover, it enables project managers to focus on higher-level tasks such as strategic planning and team building instead of tedious administrative tasks. This implies that, integrating AI decision-making systems into construction project management offers an unprecedented opportunity to bridge the optimization gap between traditional general contracting practice and modern data-driven optimization tools.

AI's Revolutionizing Progress Monitoring in CE Manufacturing

According to a study conducted by Cognizant, artificial intelligence can significantly enhance the monitoring of progress in the field of civil engineering. The study found that through AI, construction sites could be monitored and analyzed in real-time through the use of various sensors and cameras. This enabled engineers and project managers to identify potential productivity issues or safety hazards promptly, leading to faster resolution times. In addition, AI software could accurately detect defects and anomalies in building materials during all phases of construction – from pre-construction planning to post-construction inspection – ensuring that buildings are constructed with high precision and quality. With this kind of advanced system in place, CE professionals can more easily monitor their projects' progress in real-time without spending excessive amounts of time physically present on site. As stated by one of the respondents, *"Aapreciate mo talaga sya mas nakikita yung progress parang ano mo lang sya eh secretary mo sya, as a manageer na aapreciate mo sya , ang secretary eh nakikita nya lahat kung ano ang problema eh i report nya sayo ganiyo ganyan ganun din ito eh, ganun din ang AI."*

The Future of Precise Construction

"As of the moment, AI is part of the planning already which is in part of autoCAD. Without drawings, it is so hard for us to visualize the said project without a drawing reference such as orientations, elevations and many more" said by one of the respondents. AutoCAD, an AI-powered computer-aided design (CAD) software, has become an indispensable tool in the field of Civil Engineering. It offers a range of benefits that contribute to efficient project planning and execution. The software enables engineers to

create detailed and accurate drawings, facilitating project visualization and effective communication among stakeholders. AutoCAD's precision and accuracy features ensure that every aspect of the project is correctly documented, minimizing errors and inconsistencies. It also offers time and cost efficiency through templates, libraries, and automated drafting tools, reducing manual rework and design change costs. Additionally, AutoCAD provides advanced design capabilities, including parametric modeling and 3D visualization, allowing engineers to explore innovative designs, evaluate feasibility, and enhance coordination among building systems. These advantages are supported by studies conducted by Liu et al. (2021) and Ganta et al. (2018).

Recent research in civil engineering has shown that incorporating artificial intelligence (AI) in the design and planning phases of projects significantly improves accuracy. A study conducted by researchers at Stanford University found that AI algorithms could predict structural performance with greater precision than traditional methods. By analyzing massive amounts of data and identifying patterns, AI systems can produce more accurate forecasts and suggest optimizations to designs. Furthermore, a report published by McKinsey & Company highlights how leveraging machine learning techniques has helped reduce errors and improve project outcomes across various construction projects. The use of AI in CE allows engineers to make informed decisions based on data-driven insights, resulting in more efficient and cost-effective construction processes. Employing such technology will likely continue to enable the optimization of infrastructure development for years to come (Pegel et al., 2021).

Beyond the Limits of Imagination

Research findings indicate that artificial intelligence (AI) is more advanced in Central Europe compared to other regions of the world. A study conducted by Startup Heatmap Europe, which surveyed over 1,000 start-ups across Europe, found that Berlin-based companies are leading the way in AI development and application. They attribute this to Germany's strong support for research and development and its focus on creating an ethical regulatory framework for AI. Additionally, academic research from institutions such as Hungary's Budapest University of Technology and Economics have contributed significantly to AI technology advancements in the region. As stated by one of the respondents, *"I can say across ahh working abroad is more advanced technology so yeah...napaka advance ang technology nila and ahhh fast phasing yung technology compared to Philippines"* (I can say across ahh working abroad is more advanced technology so yeah...their technology is very advanced and ahhh fast phasing technology compared to Philippines)

Also, according to a report published by Stanford University, AI research and development in Central and Eastern Europe (CEE) has experienced significant growth in recent years. The study analyzed research output from CEE countries from 1998-2017 and found that the number of publications on machine learning and artificial intelligence has increased dramatically. In comparison, US-based researchers have published fewer papers in this field over the same period. Another study by Tencent Research Institute found that Chinese universities have produced more high-quality AI research outputs than their counterparts in America. These findings suggest that AI research may be more advanced in CEE and China compared to the US. This trend is expected to continue as these countries

invest heavily in AI development and establish themselves as major players in the global technology market. This implies that, reached suggests that there is a discrepancy between the level of AI technology in the Philippines and that of other countries.

Traditional Roots of the Philippines

Research conducted by Goh et al. (2020), which assessed the proficiency level of construction professionals from five Southeast Asian countries, including the Philippines, concluded that Filipino engineers and architects possess lower technical skills and knowledge, particularly in modern methods of construction. Moreover, another study by Zhang et al. (2019) revealed that despite advancements in digital technologies and building information modeling (BIM), which enhance collaboration and efficiency on-site, these innovative solutions have not yet been fully adopted in Philippine CE practices compared to developed countries such as Japan and Australia. As stated by the respondent, *"yung kwan compared sa Philippines sorry pero very traditional tayo kasi meaning traditional manual approach o conventional approach parang ganyan unlike in abroad they are automating to speed, mas expert umm in certain projects so yun nga"*(When compared to the Philippines, sorry, but we are very traditional, meaning traditional manual approach or conventional approach, unlike abroad, they are automating to speed, more expert, umm, in certain projects, so that's why)

However, according to a report from the International Labour Organization (ILO), the country's construction sector has shifted towards modernization, with an increasing number of firms adopting advanced technologies such as Building Information Modelling (BIM) and Pre-Engineered Buildings (PEB). Moreover, a study conducted by Constructech Magazine found that Philippine companies are implementing automation tools like drones

and laser scanners in their projects, reducing labor costs and improving efficiency. As stated by one of the respondents, *"Ang opinion ko ngayon is it is also getting better.. improving.. uhmm we all catching up with the technology…sobrang na appreciate ko kase maraming filipino dito sa project namin na…nakaka adopt sa technology which is really good."* (My opinion now is it is also getting better... improving... uhmm we are all catching up with the technology... I really appreciate that there are many Filipinos here in our project who... are able to adopt the technology which is really good.) Similar to the others' statement, *"Pero ngayion mejo kwan naren at least kahit papaano ummm tawag neto sumasabay na ang pilipinas umm yung nga lang mas umm kailangn pa ng support sa government"* (But now it's better, at least somehow ummm the philippines is going along (adopting) ummm the only thing is more ummm more support is needed from the government). This implies that these developments demonstrate that the traditional/manual methods once used in Philippine construction are being replaced by more advanced techniques. However, there is still room for improvement since some parts of the industry have yet to embrace these developments fully.

Engineering the Future: Exploring the Power of Technology Innovation

"Ang na encounter ko lang nun eh yung technology innovation thru engineering" (The only thing I encountered was technology innovation through engineering) said by one of the respondents. Technology innovation through engineering is a dynamic and ever-evolving field that plays a vital role in shaping the modern world. It involves the application of scientific principles, creativity, and problem-solving techniques to develop new and improved technologies that enhance various aspects of human life. This process often

entails the utilization of advanced engineering methodologies and tools to drive innovation, revolutionize industries, and address societal challenges. By combining cutting-edge research and practical implementation, technology innovation through engineering has the potential to yield groundbreaking solutions that propel us towards a more advanced and efficient future.

One study by Johnson et al. (2022) delved into the impact of engineering-driven technology innovation on the renewable energy sector. The researchers explored how engineering advancements in solar panel design and production techniques have led to increased energy efficiency and cost-effectiveness. By integrating novel materials and optimizing manufacturing processes, their findings revealed a significant enhancement in the conversion efficiency of solar cells, resulting in greater renewable energy generation. This study highlights the crucial role of engineering in driving technological breakthroughs that promote sustainability and combat climate change.

Another relevant study conducted by Chen et al. (2023) investigated the role of engineering innovation in the development of autonomous vehicles. Through a comprehensive analysis of emerging technologies such as artificial intelligence, sensor systems, and connectivity solutions, the researchers demonstrated how engineering advancements have transformed the automotive industry. Their study highlighted significant improvements in vehicle safety, energy efficiency, and transportation systems' overall effectiveness. By leveraging engineering-driven technology innovation, autonomous vehicles are expected to revolutionize mobility, enhance road safety, and optimize traffic management in the future.

Information Dissemination Campaign

The study's findings prompted the researchers to propose an intervention. For the purpose of educating the general public about the study, the researchers created an infographic entitled "Bridging the Gap: Promoting Awareness of Artificial Intelligence".

The information dissemination infographics contain the data necessary to raise awareness of the potential uses and advantages of AI in civil engineering, to inform professionals in the field, to promote cooperation between AI experts and civil engineers, and to encourage the adoption of AI tools and techniques to increase efficiency, safety, and sustainability in projects involving civil engineering. It also contains many conclusions and insights that might be drawn from the data gathered by the respondents.

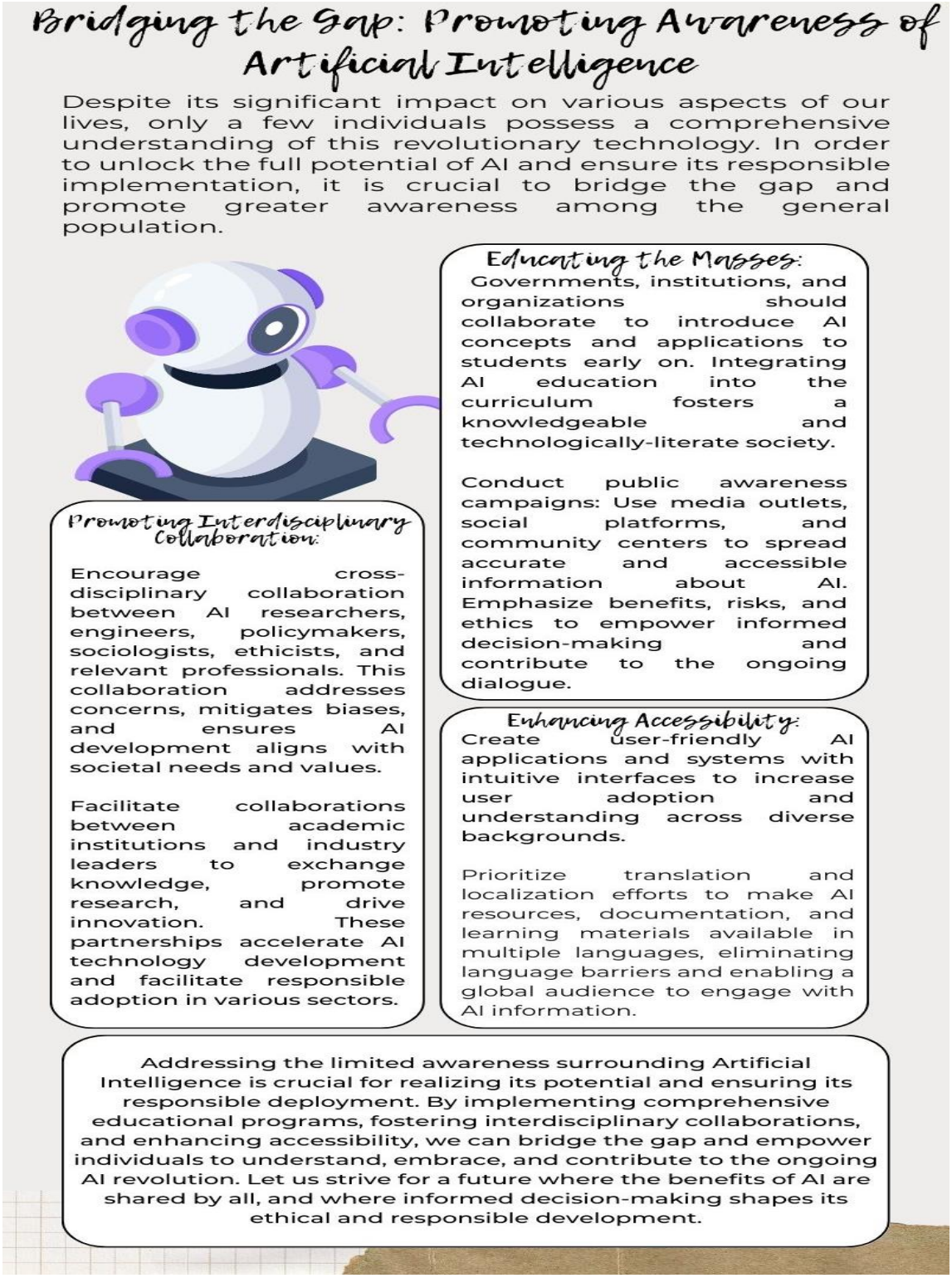

Figure 2. Information Dissemination Campaign

CHAPTER IV

SUMMARY, CONCLUSION AND RECOMMENDATIONS

"The Emergence of Artificial Intelligence in Civil Engineering" has revealed the transformative potential of this technology within the field. AI has the capability to revolutionize various aspects of civil engineering, including design, construction, maintenance, and project management. The integration of AI technologies, such as machine learning, robotics, and data analytics, offers numerous benefits, including improved accuracy, efficiency, and safety in civil engineering practices. Through qualitative research and thematic analysis, we have gained valuable insights into the AI technologies that have emerged in civil engineering, the introduction of AI to engineers, the experiences of civil engineers with AI, and the potential interventions based on our findings.

This study revealed that software programs such as AutoCAD, STAAD, and Primavera P6 are among the prominent AI technologies that have revolutionized the civil engineering industry. However, drone with GPS, radio frequency identification (RFID), building information modeling (BIM), and entertainment systems of cars have also emerged from the answers of the respondents. These new AI technologies were introduced to engineers through educational institutions and science-fiction media, allowing them to streamline their work processes, minimize potential hazards and risks, manage projects faster, and enhance overall efficiency. The utilization of these software programs has enabled engineers to design and construct complex structures with greater accuracy and precision.

It can also be concluded from this study that other countries abroad have more advanced AI technologies in civil engineering than here in the Philippines. However, the developments demonstrate that the traditional/manual methods once used in Philippine construction are being replaced by more advanced techniques. There is still room for improvement since some parts of the industry have yet to fully embrace these developments.

Overall, the study reveals the significant impact of AI in civil engineering and highlights the potential interventions that can further enhance its adoption in the field. By leveraging AI technologies, civil engineering can continue to evolve and achieve higher levels of efficiency, safety, and innovation.

Taking these findings into consideration, it is advised for those who are not fully knowledgeable of AI to go over the information dissemination brochure prepared by the researchers to improve everyone's knowledge about the experiences of Civil Engineers using AI and gain insight into the emergence of it. Additionally, it is recommended that the Philippines continues to foster the adoption of AI technologies in civil engineering. Efforts should be made to bridge the technology gap with other countries, such as through collaborations, knowledge sharing, and investment in research and development. Educational institutions should update their curricula to include AI-related courses and training programs for engineers and construction professionals. Additionally, industry stakeholders, policymakers, and regulatory bodies should work together to establish guidelines, standards, and incentives that promote the responsible and ethical use of AI in civil engineering practices.

By embracing AI technologies and implementing these recommendations, the Philippines can further enhance its civil engineering industry, ensuring it remains competitive, innovative, and capable of delivering projects with improved efficiency, accuracy, and safety.

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"Our Research | McKinsey Global Institute | McKinsey & Company." *Www.mckinsey.com*, www.mckinsey.com/mgi/our-research/all-research.

APPENDICES

APPENDIX A

Validation Tool for Interview Questions

Region I
La Union Schools Division Office
REGIONAL SCIENCE HIGH SCHOOL FOR REGION I

RESEARCH INSTRUMENT
VALIDITY TESTING TOOL

Research Title:	The Emergence of Artificial Intelligence in Civil Engineering
Proponents:	CUARESMA, Sunshine F. PABONA, Gwenn M. SORIA, Jessica Sarah L.
Research Problem with Specifics:	This study aims to explore, know, and discern the experiences and gain insight into the emergence of Artificial Intelligence in the field of Civil Engineering. Specifically, it sought to answer the following questions: 1. What are the Artificial Intelligence that emerged in the field of Engineering; 2. How was Artificial Intelligence first introduced to the Engineers; 3. What are the experiences of the Civil Engineers with the Artificial Intelligence; and 4. What intervention can be proposed with the findings of the study?

Rate the Research Interview Questions according to its Content Validity. Put a check (√) mark as your rating for the instrument.

Criteria		**5**	**4**	**3**	**2**	**1**
		Very highly valid	**Highly Valid**	**Valid**	**Somewhat Valid**	**Not Valid**
Content Validity	The test fully represents what it aims to measure.	✓				

Comments & Suggestions:

None

Validator:

JOEL F. LETI
Signature over printed name

04-14-2023
Date Validated

Region I
La Union Schools Division Office
REGIONAL SCIENCE HIGH SCHOOL FOR REGION I

RESEARCH INSTRUMENT
VALIDITY TESTING TOOL

Research Title:	The Emergence of Artificial Intelligence in Civil Engineering
Proponents:	CUARESMA, Sunshine F. PABONA, Gwenn M. SORIA, Jessica Sarah L.
Research Problem with Specifics:	This study aims to explore, know, and discern the experiences and gain insight into the emergence of Artificial Intelligence in the field of Civil Engineering. Specifically, it sought to answer the following questions: 1. What are the Artificial Intelligence that emerged in the field of Engineering; 2. How was Artificial Intelligence first introduced to the Engineers; 3. What are the experiences of the Civil Engineers with the Artificial Intelligence; and 4. What intervention can be proposed with the findings of the study?

Rate the Research Interview Questions according to its Content Validity. Put a check (√) mark as your rating for the instrument.

Criteria		**5**	**4**	**3**	**2**	**1**
		Very highly valid	**Highly Valid**	**Valid**	**Somewhat Valid**	**Not Valid**
Content Validity	The test fully represents what it aims to measure.		✓			

Comments & Suggestions:

In question no.2, AI should be spelled out.
The questions should have been arranged logically.

Validator:

CHARILENE A. TERRE
Signature over printed name

04-13-2023
Date Validated

Region I
La Union Schools Division Office
REGIONAL SCIENCE HIGH SCHOOL FOR REGION I

RESEARCH INSTRUMENT
VALIDITY TESTING TOOL

Research Title:	The Emergence of Artificial Intelligence in Civil Engineering
Proponents:	CUARESMA, Sunshine F. PABONA, Gwenn M. SORIA, Jessica Sarah L.
Research Problem with Specifics:	This study aims to explore, know, and discern the experiences and gain insight into the emergence of Artificial Intelligence in the field of Civil Engineering. Specifically, it sought to answer the following questions: 1. What are the Artificial Intelligence that emerged in the field of Engineering; 2. How was Artificial Intelligence first introduced to the Engineers; 3. What are the experiences of the Civil Engineers with the Artificial Intelligence; and 4. What intervention can be proposed with the findings of the study?

Rate the Research Interview Questions according to its Content Validity. Put a check (√) mark as your rating for the instrument.

Criteria		**5**	**4**	**3**	**2**	**1**
		Very highly valid	**Highly Valid**	**Valid**	**Somewhat Valid**	**Not Valid**
Content Validity	The test fully represents what it aims to measure.		✓			

Comments & Suggestions:
None
Validator:

EMELAINE M. AREOLA
Signature over printed name

04/13/2023
Date Validated

APPENDIX B

Validated Interview Questions

Region I
La Union Schools Division Office
REGIONAL SCIENCE HIGH SCHOOL FOR REGION I

1. What are the new Artificial Intelligence's that you already encountered?
   (Ano ang mga bagong Artificial Intelligence na na-encounter mo na?)
2. How was Artificial Intelligence first introduced to you?
   (Paano unang ipinakilala sa iyo ang Artificial Intelligence?)
3. What benefits could Artificial Intelligence bring to Civil Engineering projects?
   (Anong mga benepisyo ang maidudulot ng Artificial Intelligence sa mga proyekto ng Civil Engineering?)
4. How could Artificial Intelligence be used to improve safety in the field of engineering?
   (Paano magagamit ang Artificial Intelligence upang mapabuti ang kaligtasan sa larangan ng engineering?)
5. How can Civil Engineers use Artificial Intelligence to avoid mistakes and to achieve greater outcome?
   (Paano magagamit ng mga Civil Engineer ang Artipisyal na Katalinuhan upang maiwasan ang mga pagkakamali at upang makamit ang mas malaking resulta?)
6. Can you state some situations wherein you appreciated or realize the impact of Artificial Intelligence in your career as an Civil Engineer?
   (Maaari mo bang sabihin ang ilang mga sitwasyon kung saan iyong pinahahalagahan o napagtanto ang epekto ng Artificial Intelligence sa iyong karera bilang isang Civil Engineer?)
7. Base on your experiences with AI, differentiate your work experience here in the Philippines and abroad?
   (Base sa iyong mga karanasan sa AI, ihambing ang iyong karanasan sa trabaho dito sa Pilipinas at sa ibang bansa?)

APPENDIX C
Level of Validity of Interview Questions

Table 1. Level of Validity of Interview Questions

The validity of the interview questions as the research tool for this study was interpreted using the five-point Likert Scale. The scale is as follows:

Point Value	Statistical Range	Descriptive Equivalent Rating
5	4.51-5.00	Very High Validity (VHV)
4	3.51-4.50	High Validity (HV)
3	2.51-3.50	Moderate Validity (MV)
2	1.51-2.50	Poor Validity (PV)
1	1.00-1.50	Very Poor Validity (VPV)

With the scale use to interpret the research instrument, the total average got from the validation tools is 4.67 which fall under Very High Validity (VHV). The errors and recommendations will be applied on the interview questions for proper conduction and guide questions on the interview that will be held.

APPENDIX D
Communication Letters

REGIONAL SCIENCE HIGH SCHOOL FOR REGION I
Ma. Christina East, Bangar, La Union

April 11, 2023
JOEL F. LETI
Master Teacher I_ _
Pudoc West Integrated School

Sir:

We, the undersigned students are from the Regional Science High School for Region I. As part of our subject, **Practical Research I**, we are currently doing a research project entitled, **The Emergence of Artificial Intelligence in Civil Engineering.**

In this regard, may we humbly request for your time to please **validate our Data Gathering Tool – Interview Questions**. The result of this validity test will be reflected on our write-up of Chapter II which will be submitted before the Third Quarterly Test on April 20-21, 2023.

We look forward for a favorable response regarding this humble request in the name of noble cause of research.

Thank you and may the Lord bless you with thousand folds.

Very truly yours,

SUNSHINE F. CUARESMA

GWENN M. PABONA

JESSICA SARAH L. SORIA
Grade 11 Researchers

Noted:

ANTONIETTE G. PADUA
Research Adviser

REGIONAL SCIENCE HIGH SCHOOL FOR REGION I
Ma. Christina East, Bangar, La Union

April 11, 2023
CHARILENE A. TERRE_ _
Teacher I_ _
Tagudin National High School

Madam:

We, the undersigned students are from the Regional Science High School for Region I. As part of our subject, **Practical Research I**, we are currently doing a research project entitled, **The Emergence of Artificial Intelligence in Civil Engineering.**

In this regard, may we humbly request for your time to please **validate our Data Gathering Tool – Interview Questions**. The result of this validity test will be reflected on our write-up of Chapter II which will be submitted before the Third Quarterly Test on April 20-21, 2023.

We look forward for a favorable response regarding this humble request in the name of noble cause of research.

Thank you and may the Lord bless you with thousand folds.

Very truly yours,

SUNSHINE F. CUARESMA
GWENN M. PABONA
JESSICA SARAH L. SORIA
Grade 11 Researchers

Noted:

ANTONIETTE G. PADUA
Research Adviser

REGIONAL SCIENCE HIGH SCHOOL FOR REGION I
Ma. Christina East, Bangar, La Union

April 11, 2023

EMELAINE M. AREOLA_ _
Master Teacher I_ _
Luna National High School

Madam:

We, the undersigned students are from the Regional Science High School for Region I. As part of our subject, **Practical Research I**, we are currently doing a research project entitled, **The Emergence of Artificial Intelligence in Civil Engineering.**

In this regard, may we humbly request for your time to please **validate our Data Gathering Tool – Interview Questions**. The result of this validity test will be reflected on our write-up of Chapter II which will be submitted before the Third Quarterly Test on April 20-21, 2023.

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Thank you and may the Lord bless you with thousand folds.

Very truly yours,

SUNSHINE F. CUARESMA
GWENN M. PABONA
JESSICA SARAH L. SORIA
Grade 11 Researchers

Noted:

ANTONIETTE G. PADUA
Research Adviser

APPENDIX E
Informed Consent

Region I
La Union Schools Division Office
REGIONAL SCIENCE HIGH SCHOOL for REGION I
Bangar, La Union

INFORMED CONSENT

The Emergence of Artificial Intelligence in Civil Engineering

One of the requirements of the Grade 11 learners in their Practical Research I subject for the Science, Technology, Engineering and Mathematics (STEM) Strand, Academic Track of Regional Science High School for Region I is to produce a Qualitative Research study.

The purpose of this qualitative descriptive research entitled **"The Emergence of Artificial Intelligence in Civil Engineering."** The purpose of this interview is to explore, know, and discern the experiences and gain insight into the emergence of Artificial Intelligence in the field of Civil Engineering. This study will be conducted by the following researchers: **Sunshine F. Cuaresma, Gwenn M. Pabona,** and **Jessica Sarah L. Soria.** The Civil Engineers and other people will benefit in this study in order to understand the lived experiences of Civil engineers using Artificial intelligence. Hence, if you agreed to participate, you are encouraged to answer the questionnaires honestly during the online interview. The researchers will record the actual process by video or audio recorder for proper documentation. Rest assured that all your responses and the recordings will be kept confidential and will be used for educational purpose only upon your approval. Thank you for your kind cooperation.

I have read the preceding information. The researchers have given me a chance to ask questions about it and I am convinced with all the answers they have given me. This is to certify that I willingly participate on the said study.

Print Name of Participant: _____

Signature of Participant: _____

Date: _____

APPENDIX F
Transcribed Data

La Union Schools Division
REGIONAL SCIENCE HIGH SCHOOL FOR REGION 1
Bangar, La Union

Question 1	What are the new Artificial Intelligence's that you already encountered?	Codes
Respondent 1	Uhh number one.. when you are working is uh.. the email.. internet.. when you are working now currently is uh… if you don't have email means you cannot send uh message or you cannot reply what is you wanted to uhh inform or what you want to relay and then second is a like a drone.. uhmm.. we are working with a drone for surveying and heavy equipment with global positioning system (GPS) yuh yuh, and also.. system like that.. especially those computer like auto cad uh like… softwares that uh make the work easier and faster yeah. Those are.. kind of.. that I encountered.. software systems especially..	Software (AutoCAD, STAAD, Primavera P6) Drone with GPS (Drone surveying)
Respondent 2	uhmm marami hahahah pero meron lang basic ahhh encounter ngayon marami ng artificial ngayon diba sa AI through facebook so maraming... jan di kyo nagsasawa na famous through facebook be need what a be need a Ao ai to being famous mga ganon na encounter niyo ba yun?? oh dibaa ai na yun hahahaha so if u are familiar with a ahh radio frequency identification alam niyo yan yung radio frequency identification na yan???....familiar ba dito? yun yung radio frequency identification yung RFID ngayon sa more ahh yun yung ncr in north luzon more in 2.. diba natanggal na yung mga trabahafor na jan tapos nagau automate na lang yung sasakyan na pumapasok sa ncr ahhh meron nalang jan yung bayara sa freepay were u have a load u can entrance exit in the their gate so u call this one RFID , ano na to na encounter niyo na? pumunta naba kayo sa manila?have u tried to ride a car or motor with speno car hundred CC in the express	Radio Frequency Identification (RFID) Building Information Modelling (BIM)

	way and exit in the ncr?? natesting niyo na? helloo?? ayunnn, yun ang kwan so in my side as a civil engineer of course we have a automate were trying to automate ahh our desgn not only for daily..sa mga. u need u also practice how to ahh practice how to make an ai in my automize my ahh lrojct fo example BIM, bim not a beam ahh.. B I M ahh yun sa ahh building information modeling so ito ang ino automate nya ksama to ng ahh kasama ng mga engineers architect pero sama sama to mga engineers soo u combine their works to make it ahh to make it their modeling ahh in the help they will analyze their design the structural design yun is ayun sa mga ai sa industry ng engineering and also sa civil engineer so yun yun yung mga nae encounter ko	
Respondent 3	The new AI that I have encountered is within the entertainment system of a car.	Entertainment system of a car
Themes : Software (AutoCAD, STAAD), Drone with GPS (Drone surveying), Radio Frequency Identification (RFID), Building Information Modelling (BIM), Entertainment system of a car		
Question 2	How was Artificial Intelligence first introduced to you?	
Respondent 1	Uhmm.. uhh.. it was introduced to me some kind of what uhh like a scifiction when i'm a still young ofc.. i didn't.. i didn't know that time that ahh cause... ofc i'm... bata pa ako non e, and when im studying and ahh taking highschool and college my u derstand on AIbecome deeper and ahh appreciation and ahh.... on it and what... ai is that really has been ahh.. na identify ko siya so... like for example ahh emails mga like that.. sa example of the ai is an artificial intelligence like also calculator.. this are the simple ahh and internet.. so... i thought nung una ah syempre ahhh nung bata kapa diba? ahh ang alam mong ai is yung parang... mga robot or Advance technology but ahh simple technology alsosshh one of them soo..yeah that is how i introduced to be (dik naawatan..	School (High school and College) Science fiction

Respondent 2	Artificial intelligence.. well for AI, artificial intelligence, as of this current.. that we are in, in this uh.. where are aiming now in this world, so AI.. yung AI natin is more in computer system, so.. that can learn and work on its own, so more in decision, ito yung kwan reason na data-base yung data, so more in data siya, uh… it helps the human being, so tinuturuan tayo nito to reduce the chance of manuwalya or so.. ito yung AI natin.. sakin. Hindi ko alam kung anong kwan ngayon for.. ten years or after ten years.. more on AI na tayo. So ma lelessen yung kwan mga trabaho sa buong mundo, and more on robotic yan.. more on automation sya, so.. advantage sa processing yan.. mga jobs natin mas marami yan, so.. more efficient, more efficient sila, less likely to creating issues, so.. mas.. limit lang yung error nila compare us human being. Yon lang, yon lang ang kwan saakin ng AI so..more in computer system siya that can work on its own… data, yon lang…	None
Respondent 3	AI has been first introduced to me by a friend of mine in college.	School (High school and College)
Themes: School (High school and College), Science fiction		
Question 3	What benefits could Artificial Intelligence bring to Civil Engineering projects?	
Respondent 1	Umm of in terms to um sa engineering um of course makes it safety and umm completes it works easier on large scale project and u the makes its systemice and organize and also umm in collecting datas and information its more on uhh in ahh precise one so ot helps in collecting data and more precise and design and planning also operation uhh quickly generate asses and um maging ang mga facilities maka kwan ng project so madami syang mga benipisyo so for me is mostly in safety that is what i encountered and yung mga large scale projects eh makaka... Mostly	Safety/Safer Faster completion of projects More precise data and information

	kailangan ng maraming tao kailangan mo ng maraming ano pero kapag ka may AI system, o merong system, software system ang company magiging organize sya so yung pang design planning at yung operation including the project management ay magiging organize sya yun yung nakikita kong benifits ng AI sysytem yun like for example if you are sending an email you just go to your laptop and software office so kung mag sesend kana ma sesend mo na, like maybe 50 years ago you need to send meet memo and hand writiting and this one taking .... A scale so when yku have to go to the office and mawawala yung memo na yon while he is on the way so yun yung nakikiya kong ano uh na send mo na yung email in a second 10 minutes mababasa na nung correspondents yung gusto mong iparating.	
Respondent 2	Okay, as a civil engineer.. there's a lot of benefits of AI.. how.. since the computer system will, nakakatulong ito satin ngayon. For me, as a CE, this benefits.. it will pre-generate the access the quality of the design facility, so lahat ng mga design naming, napapabilis, yung.. tawag nito.. lahat ng mga error na possible erroe ng design nakikita agad so yung productivity ba napapabilis. Very very useful ito ngayon sa atin compared to before uhh na moe in manual.. traditional and conventional meaning manual, baka ma ano kwan tayo dito… more in talagang one on one ba.. tawag nito yung other term nya.. yung.. uhh… minamanual mo lang.. halimbawa yung calculator minamual mo ganyan.. ngayom hindi na eh, so we have many tools or more in computer system na.. that gives benefits to easy monitor the deliveries and delays of the projects, so marami tayong tools ngayon, so.. kumg ako sainyo, mas Maganda kung matuto kayo sa.. more on AI's ngayon.. mas progressive kayo.. mga AI siya… more in output… so yung output nung kwan… maraming output yung AI na manggagaling yon sayo, pinapabilis nya lang yung mga kailangan mong gawin… benefits to our life.. yung good sides nya marami.. yung mga delay mo sa projects uhh napapabilis nya ganyan, namomonitor mo yung problema, so yung potential risks.. yung risk na	Faster completion of projects Minimize potential risk/errors

	magkaroon ka ng problema, big factor na makikita mo siya, so, more in benefits talaga siya.. sa part ng civil engineering.. manager.. yun lang	
Respondent 3	The best possible way of AI system that could do for CE is that it can minimize errors which can lead to a greater commission or profit, it can achieve the project within the time schedule set. With regards to planning, it can give best possible solutions and set of possibilities on how to achieve the project base on the given resources. It can be easily to present the project base on what the client wants to the said structure or project.	Minimize potential risk/errors Faster completion of projects (on time)
Themes: Faster completion of projects (on time), Minimize potential risk/errors, More precise data and information, Safety/Safer		
Question 4	How could Artificial Intelligence be used to improve safety in the field of engineering?	
Respondent 1	ahhmm.. syempre ahmm ang ai kapag ang input kang mga datas base on ahhh ... ahh testing and some face bill key ahh study at makakaidentify after ka maanalyze kase ng system kung ahm software kana...system ka na ma identify nyakase yung .. u can identify potential safety hazard and uhh to reducing of accident uhmm mostly pa nga eliminate mga elimination of the ahh high risk... uhmm makakapagprpvide din soya ng insight and ahh makakapag lead siya sa simght smarter and efficient way and like for example ahhh using some software in ahh building construction when signing like a sta ad and ahh yung staad kase isa siyang tools na design sa pag design ng mga ahh sa building kunyare montestol na building so from there ihh kapag ininputmo yung mga requirements dun sa software base on some for like example 24 story ininput mo don kung ano yung mga datas na kaylangan mo ahmm yung ahhh ilang floor ilan yung width and length ng bawat ahhh stoty makaka makakacome out kase yung software kung ilan yung ahh plan ng pundasyon ahhh yung lai ng column yung bims atchaka yung requirement din yung yung mga process and op nya so from there mai gegenerate nya kung ano yung talagang requirement. na mgiging safe yung building at makikita mo din yung possibilities kung anong mangyare sa building kunyare may earthquake or ahh typhoon	Minimize Potential Hazards and Risk Possible effects of Disasters (earthquake, typhoon, etc.) are generated

	ganon so from there base on mga collective datas maka get na gawa yung ahh software na yun ahhh atchaka base on ahh structural codes syempre maka uhmm ginawa yung software na yun dun mo palang minout unlike kapag ka manual sa total area pag nagkamali yung computations mo u go back again to zero back to square one and ahhto copy again unlike ahh we hav a software so just input the and then u will come up with a safe design ahh building structures then and yung ano ahmm another one ahmm just make u this project is yung drown ahh idk king ahh aware kayo surveyor mostyly nagalalkad silagamit yung ahh anong tawag nan ahhh gamit yung mchine instrument naglalakad sila ganyan pero kapag may drown ka ipapakipad mo yung drown base on collective datas ulet atchaka may software yung gagamitin mo para sa droan ahh yung mga accessable areas at chaka platforms mga pas nng droan makapag kuha ka ng survey na hindi mo na kailangan pumunta doon na maybe is that safe area so u just fly a droan and then u can take whatever u needed to ganon... soo ahh nai eiliminate mo yung high risk na potential nahazard doon na kapag jilipadmo yung drown dina kaylangan pumunta yung tao lara maglakad doon sa are dun naman sa pag design bago itayo palang yung building makikita mo na kung ano yung potential na mangayre sa building madedecide mo iya dahil sa mg software atchaka mga ahh ahmm ahh ahhh ahhh ahh Advanxe technology na nagagwa	
Respondent 2	uhmm in a part of safety as a civil engineer okay. syempre i take care in a artificial intelligence is yeah malaking tulong din to inthe part of a even in the ahh civil engineering na work place sobrang laking tulong nito syempre it helps the safer.. environment... so ayan na identify nya yung potential of hazard every... naidentify nya so in, in ahh computer system or let say sa artificial intelligence ahh naidentify nya yung.. so yun mga potential hazard yun yung sinabi ko kanina so yung behavior din ng... yung yung mga trabahador mo nai identify nya Rin soo pati yung mga issues	Minimize Potential Hazards and Risk

	nga incoming issues naidentify nya ahh pati yung mga ahh unseen behavior ahh the incoming accident mga yun na anticipate nya so compare sa manual talaga na ilang tao kase eh napractice nya naga antay tapos malalaman.....well ito kase when u are in Planning bwfore u start a project were are... megaprojects sa main project u need to anticipate everything before u will start a project so ahhh ito yung ai na sinasabi nila as a Manager or as a owner lf this project or megaprojects ahhh na anticipate mo lahat ng... so as a civil engineer or even im a civil engineer in a one project so use our.... na naa na anticipate ko yung magiging problema ahhh finally ahhh nadedevelop to ng kwan yung.... nagdedevelol to ng safety technologies and protocols so it will make a project safe and ur team or even ahhh the labors lahat ng mga ... sa project na yun nagiging safe sila so ito yung im improvement ng isang ai maraming kwan to malaking tulong talaga as in sobrang laking tulong nito kaya wag natin kwan ang ai kapag sinabi mong ai kaya walang tiwala e ehh ngayon sa totoo lang nagi improve din ang ai mas safe na compared to traditional practice na mas maraming ahh mas productive talaga siya compared sa ahh all practice natin... yun.	
Respondent 3	Nowadays, safety is priority of the said field of interest. So, Ai then could help in the form of setting up a system or application on what could be the proper procedure to finish the project without compromising safety. Let's say for example, during working in a confined space, the AI could set up a system or application on what are the things to comply prior in working within a specific area of location to prevent such fatalities or accident to happen.	Minimize Potential Hazards and Risk
Themes: Minimize Potential Hazards and Risk, Possible effects of Disasters (earthquake, typhoon, etc.) are generated		
Question 5	How can Civil Engineers use Artificial Intelligence to avoid mistakes and to achieve greater outcome?	
Respondent 1	uhm.. may mga design engineering input tayo na uhm base on theory, so base on this theory, uh.. 8 years ago, wala pa tayong mga computers that time so manual, so.. uh etong mga theory na ito i-	Minimize the errors to maximize the profit

	input dun sa systems like… iniinput yung mga collected datas dun sa.. tas nakakapag generate ng system at dun sa naiilalagay dun sa machine naiincorporate kasi.. meron na kasi mga machines ngayon tulad mga.. excabator.. dati wala siyang mga display so now may mmga display na siya at maiinput mo na, machecheck like for example ay yung excabator mo or machine mo yung dump truck mo uh walang mga camera.. reverse camera ngayon nailalagay na yung mga yon nakikita mo na. so.. base dun sa mga engineering datas uh naiinput dun sa mga equipments nagkakaroon ng enable yung engineer or yung management na magkaroon na sya ng.. visual overview para likr uh for example project siya, makikita na nya yung estimated costs o outcome nung project para ma.. as well yung outcome uh.. prior to.. potential plan para mapagplanuhan nya nya yon.. so from engineering collected datas, iiinput doon sa machines, which is become.. artificial intelligence applications, ganon siya, so hindi naman makakapag come out uh.. ng technology kung wala ka namang engineering datas na iiinput doon sa machines uh.. doon sa machines aaply mo, iaaply mo siya para maging uhh.. maging easier yung trabaho, maging safe yung trabaho.. or function nya magiging multi, so yeah, ang uh.. ahh.. sa engineering diba mostly math, may mga calculations, so yung mga calculation na yon uh iniinput doon sa mga system nag c-come out sila ng software tapos doon sa software.. maging.. doon sa application pa lang na aapply mo na tapos.. uh.. ganito iiinput mo lang sa software makakapag come out ka so.. it is what I think yung engineering use artificial intelligence in that way, so yung mga collected datas uhh.. mga construction code uhm.. building code, national building code, national structural code, input in that system tocome up.. a software. Yon, yun yung summarize non.. doon nagagamit yung AI	
Respondent 2	Ummm mahirap yun ah hahhahaha ummm isa dito is yung kwan tsk greater such achievement ng civil engineer with the use of AI ito yung cost construction. Alam nyo ba yung cost construction ding?, ano bang cost construction na nasaisip	The possibles hazards are anticipated

	nyo…..yung tapos na yung project so this is the benefit or we call the ummm pagkatapos kasi ng isang project syempre ano na lahat umm mag uh halo halo may kamali ka na dyan at least base dun sa pinag kamalian mo maachieve mo parin yung greater outcome mo meaning yung manager yung nag mamanage doon sa construction na yon it collects information so nag cocollect sya ng information maraming umm tools na kasi on how they will collect the the information para ummm hanggang sa cost construction eh, so na checheck nila yung performance ng structure nila or our instruction sa mga project kasi marami kaming mga projects kasi mayroong mga building, mga bridges roads mga yan. So almost everything in the field of environment ummm ito yung greater outcome namin so, um na.. Kasi yung pag bulid natin ngayon ng generation na papabilis naten eh compared before sooo malaking development to sa aten umm yung pati sa maintenance na pabilis naten um kung nakikita natin kung ano ang magigig problema yun lang yung kwan neten eh. maraming kwan maraming nag kakamali den may error sya pero ummm while you're working with the AI na checheck mo ren, so ganun paren para, hindi sa compared before pag nag kamali kasi ang hirap I backtrack ba, backtrack ang mali mo doon sa tama eh. Kompara ngayon umm with the help of computer system mabilis mo na makikita kung anong problema eh naka monitor ka lang compared before madami ka pang gagawan ito si engineer 1, engineer 2, engineer 3 madaming engineer eh di mo alam kung sino ang nag sasabi ng tama o mali eh. Soooo as a manager yung … if you're familiar with AI talaga ummm very collective ka dapat so lahat ng information alam mo umm maraming tools din na gagamit na imbes na yung problema talaga ng building eh malaking problema pero dahil sa gamit ng AI na a-anticipate mo lahat yung mga problema at mabilis mo lang sya ma overcome so magkakaroon ng magandang output ng project yun lang yung achivement ng isang CE eh so well um ano a hahah	Minimize the errors to maximize the profit
Respondent 3	Planning is the bone marrow or structure of the project. So, without planning, 99% of that project	More precise planning

	may fail. AI can give us a better perspective view on how can we handle things such as errors. Ai can be used to minimize the errors to maximize the profit by determining the errors prior to happen because we do not want double work to happen. Double work means you have done it wrong that's why you need to rectify it and with rectification means loss of man-hour and loss of resources. At the bottom, AI could be of great help in terms of planning.	Minimize the errors to maximize the profit
Themes: Minimize the errors to maximize the profit, The possibles hazards are anticipated, More precise planning		
Question 6	Can you state some situations wherein you appreciated or realize the impact of Artificial Intelligence in your career as an Civil Engineer?	
Respondent 1	uhm.. one of the.. first one is using the auto cad. Way back before highschool ako tapos nag first year college ako.. yung drawing namin nasa tracing paper manually no… nung na introduce saakin yung auto cad.. you need those technical terms ...you dont need to use rulers and draw tables you just have to buy the computer... autucad and uhh staad.. so if you compare sa manual calculations ahh.. or else using your staad that you dont know what are theories so it doesnt make sense, yeah but uh yeah isa yan sa mga gamit ng AI natin. so number one sa auto cad, sa number two, staad, and marami siya.. madami yung trimble business system and the slack business system, uhh pag check mo doon sa mga sites yung mga level base meron kang gamit na ahh.. pag punta mo sa office.. iiinpiut mo andon na yung lahat ng mga data at kailangan mo sa reporting so sobrang bilis tapos meron din kaminung drone survey, yung drone survey.. alam nyo naman siguro yung drone.. papalipad mo lang yung drone pupunta siya tapos makaka collect ka na ng mga datas base on that uhhh napalipad mo.. meron namang mga available na sd card isalpak mo doon sa computer makikita mo na makakapag come ka na ng mga overview.. yon yung mga ano ko, autocads, staad, trimble business system, uhh eto yung last na naano ko yung.. parang autocad lang naman siya pero rigid so 3d siya, makikita mo na yung uh magkakaroon ka na ng idea kung ano ang	From manual and traditional to automated

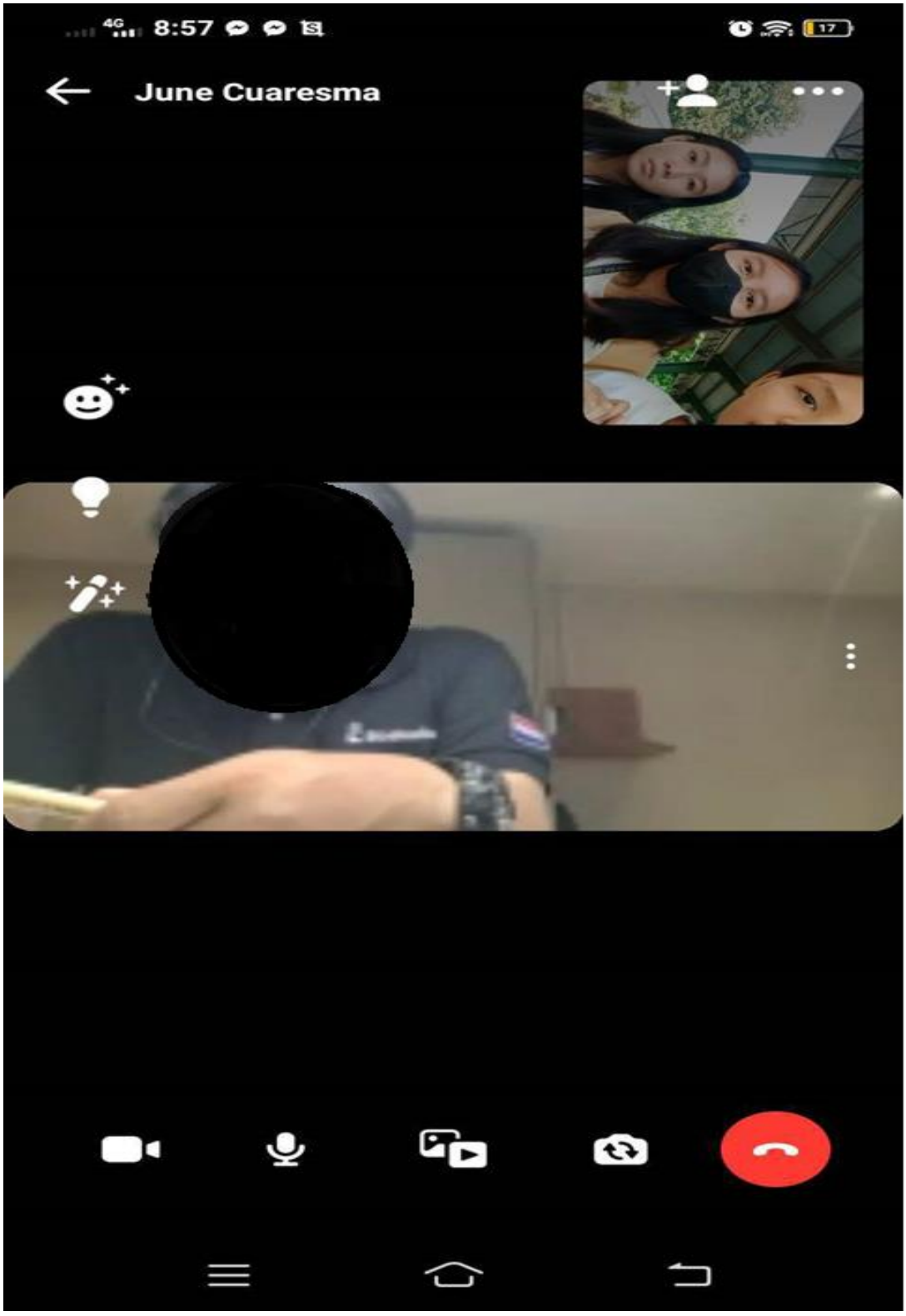
	kabuunan ng isang building so 3d siya, pero hindi ko pa siya na apply uhh ano lang uhm course lang, nag take akong course noong covid time.. uh parang maging busy but now hindi ko pa siya na apply.. kasi sa sobrang busy yon.. uhh auto cad, staad, trimble business system, yung drone surveying, uhm marami pa pero yan siguro yyung mga guto kong technology na sa career ko and nag c-contribute sa ano uh placing	
Respondent 2	Okay well…… AI in the world of Civil Engineering ang industry namin specially in a mega project we help super use in the cite to use inside to check the progress soo napapabilis naming kung ano yung uumm progress ng isang project umm …na aautomate yung repetitive task yung mga pa ulit ulit na trabaho na aautomate nya yan sa project scheduling mga ganyan cost estimation and materials selection.so one of the AI I thinks its not AI because umm yung output galing sa engineers eh yung P6 not physics ah yung subject hindi, P6 ito yung software na ginagamit namin umm to help with project scheduling when we will meet the timeline the cost estimation and materials selection ng isang structure so ginagamit namin itong program management while you can put the tawag neto pag tinitignan mo yung plano iniinput mo yung plano na estimate na nya yung umm tawag neto yung budget para sa project and then the materials umm so yun ma aapreciate mo talaga sya mas nakikita yung progress parang ano mo lang sya eh secretary mo sya, as a secretary na aapreciate mo yung , ang secretary eh nakikita nya lahat kung ano ang problema eh i report nya sayo ganiyo ganyan ganun din ito eh, ganun din ang AI um if you are a civil engineer so yung nga ma aapreciate mo sya sa software, yung progress neto mabilis to	Repetitive task are automated Project management is easier and faster Easier monitoring of progress
Respondent 3	As of the moment, AI is part of the planning already which is in part of autoCAD. Without drawings, it is so hard for us to visualize the said project without a drawing references such as orientations, elevations and many more. It helps the designer to make it 100% accurate through drawing but believe me, there is no such 100% in the field of construction during implementations.	More accurate plans/designs

Themes: From manual and traditional to automated, Repetitive task are automated, Project management is easier and faster, Easier monitoring of progress, More accurate plans/designs		
Question 7	Base on your experiences with AI, differentiate your work experience here in the Philippines and abroad?	
Respondent 1	ahh okay,, uhmm nagstart ako ng career ko 20's... Philippines. local ahh project from 2005 to 2010.. tawag na to.... that is Philippines and then from 2011 to 2022 ahh.. single for project almost... tapos na ako na ang ahh sa pilipinas sa pilipinas okayuhmm from august ay September last year and now ahh i can say across ahh working abroad is more advanced technology so yeah specially isalang naman yung abroad work ko which is Singapore kaya advance the internet is here.. so beside isang maliit na island lang siya pero napaka advance ang technology nila and ahhh fast phasing yung technology compare to Philippines, unlike here in Philippines ahhh nasa angeles ka lang peroo naubos pa yung data mo diba dimo p nacocollect yung ano mo do yeahh that is one thing and ahhh second is ahh yung system kase na ginagamit don sa ibang bansa whic is Singapore yung pinanggalingan ko ahh ano sila laging maintroduce kunyare ahh kylangan natin na ahh iniigiha itong activity nato nagkakaroon lgi sila ng software or Advance technology from that para mapabilis yung ano unlike here in Philippines...ahh nagpaka work ako ng inyong.... ahh jr. engr pako ahhh matagal siya kase manual tapos yung mga equipment hindi din siya name maintain na naa or nagkakoron ng advance narin so yeahh but ahh and i just can that soo yun din yung ina ano ko sabi ko why me working but if i canno pursue again this time bumalik ao pero sa work ko ngayon as ahh amg opinion ko ngayon is it is also getting better.. improving.. uhmm we all catching up with the technology as well so we have those light a ... projects now which is .... and then ahh now naka andito ako sa ahhh yung project na sobrang na appreciate kokase mraming filipinodito sa project namin na na na kung ngayon ehh nakaka adopt sa technology which is really good, uhmm dito ako	More advanced technology Faster internet connection

	ngayon sa... dito ngayon sa maila international airport project dito sa bulacan sooo my company is a is on Netherlands dito yung project namin ahhh marami kaseng nago ondoor ng mga kasmahan natin na filipino which is naadopt nila yung technology so yeahh na appreciate ko yun siya kase nakikita ko .. ahh.. na ano nagi improve dito sa pilipinas din so compare ahhh comparing tye technology 10yrs ago yeah so yeah yun yung ano ko opinion ko before we can say na malayo yung advancement but now i can say yeah catching up yeah and ahhh... 10yrs ago makakavideo makakavieocall ba diba hindi diba pero ngayon nakakapagmeet up din sa ano soo it is same thing din sa ibang bansa ganito rin naman pero may yeahh it is still improving and that's good yeahh yun yung ano yun yung opinion ko don yeah but ang ano ko meron din nmang lamang yung pilipinas sa iba dinaman tayo papahuli	
Respondent 2	Ohhh patay tayo jan baka mamaya tanggalin ako sa trabaho nyan HAHHAH.. well ummm base on my experience I start my first job here in the Philippines and then compared to abroad hmmm in Philippines pag pumunta kayo sa ibang bansa pinupuri kung gaano kagaling ang isang Pilipino they can multitask, very passionate sa trabaho so ummm pero in terms of computer system mas advanced ang abroad why? Kamo yung kwan compared sa Philippines sorry pero very traditional tayo kasi meaning traditional manual approach o conventional approach parang ganyan unlike in abroad they are automating to speed, mas expert umm in certain projects so yun nga ahh pero ngayion mejo kwan naren at least kahit papaano ummm tawag neto sumasabay na ang pilipinas umm yung nga lang mas umm kailangn pa ng support sa government just to finance everything.in a private sector na man kasi in a business cite marami silang kwn budget to finance the kwan perooo yung pag pumunta kasi kayo sa government even in a government sector mas mabilis pa sila compared sa private sector so yun sana ang gusto kong I adapt ng pilipinas sa atin eh they are pushing they’re men to automate yung mapapabilis ba yung trabaho o yung productive	Philippines is very traditional(manual) More advanced technology

	compared to traditional approach na mabagal umm tayo kasi… tayo noon kasi magaling na tayo diba. Pag pupunta ka sa ibang bansa i aaproach ka ng ikaw yung employee sila yung boss, pero kapag sila ang pumunta ditk sa pilipinas sila parin ang boss so i think mas kwan sila eh advanced sila compared sa atin, kapag ibang lahi ang pupunta sa atin sila pa magiging boss so big question yun, tayo iilan lang yung pupunta sa ibang bansa tas sila magiging boss na pilipino pero dito eh kita mong ibang lahi boss na sila thet are the manager sana sa pilipinas tayo ang boss eh they will work with us uhh abroad is very focused in new system um specially sa malalaking projects focused sila jan satin san ganun din.	
Respondent 3	Yung sa 7 ading hindi ko alam isasagot ko ngy? Hahaha kasi wala akong experience Philippines	None
Themes: More advanced technology, Faster internet connection, Philippines is very traditional(manual)		

Interview Process Documentation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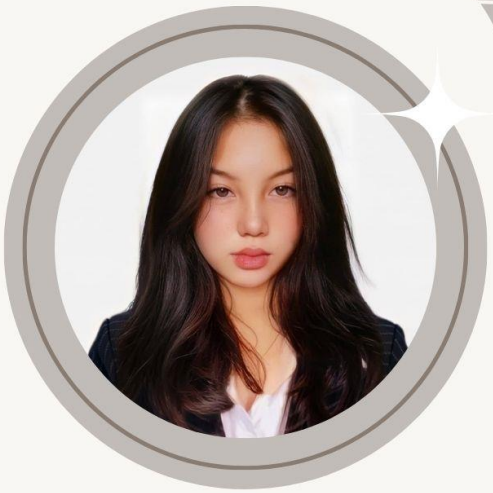
June Cuaresma

CURRICULUM VITAE



PERSONAL INFROMATION

NAME: SUNSHINE F. CUARESMA

AGE: 17

GENDER: FEMALE

DATE OF BIRTH: JANUARY 28, 2006

CURRENT ADDRESS: DACUTAN, TAGUDIN, ILOCOS SUR

CIVIL STATUS: SINGLE

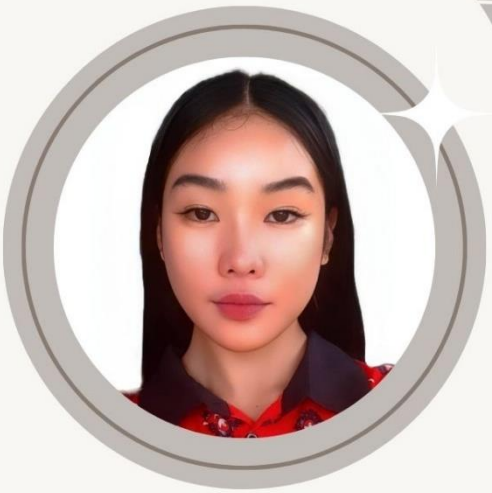
NATIONALITY: FILIPINO

EDUCATIONAL BACKGROUND

ELEMENTARY: LAS-UD ELEMENTARY SCHOOL

SCHOOL SECONDARY: TAGUDIN NATIONAL HIGH SCHOOL

CURRICULUM VITAE



PERSONAL INFROMATION

NAME: GWENN M. PABONA

CIVIL STATUS: SINGLE

AGE: 17

NATIONALITY: FILIPINO

GENDER: FEMALE

EDUCATIONAL BACKGROUND

DATE OF BIRTH: NOVEMBER 7, 2005

ELEMENTARY: CANTORIA CENTRAL SCHOOL

CURRENT ADDRESS: CANTORIA 3, LUNA, LA UNION

SCHOOL SECONDARY: REGIONAL SCIENCE HIGH SCHOOL FOR REGION 1

CURRICULUM VITAE

PERSONAL INFROMATION

NAME: JESSICA SARAH L. SORIA

AGE: 16

GENDER: FEMALE

DATE OF BIRTH: JUNE 29, 2006

CURRENT ADDRESS: PACAC, TAGUDIN, ILOCOS SUR

CIVIL STATUS: SINGLE

NATIONALITY: FILIPINO

EDUCATIONAL BACKGROUND

ELEMENTARY: PUDOC WEST INTEGRATED SCHOOL

SCHOOL SECONDARY: REGIONAL SCIENCE HIGH SCHOOL FOR REGION 1