Wednesday, March 4, 2026 2:02 PM

Project Title

Developing and Managing a Cloud-Based Smart Energy Monitoring System

Module

ACCA5033 – Changemakers: Creativity and Value Creation

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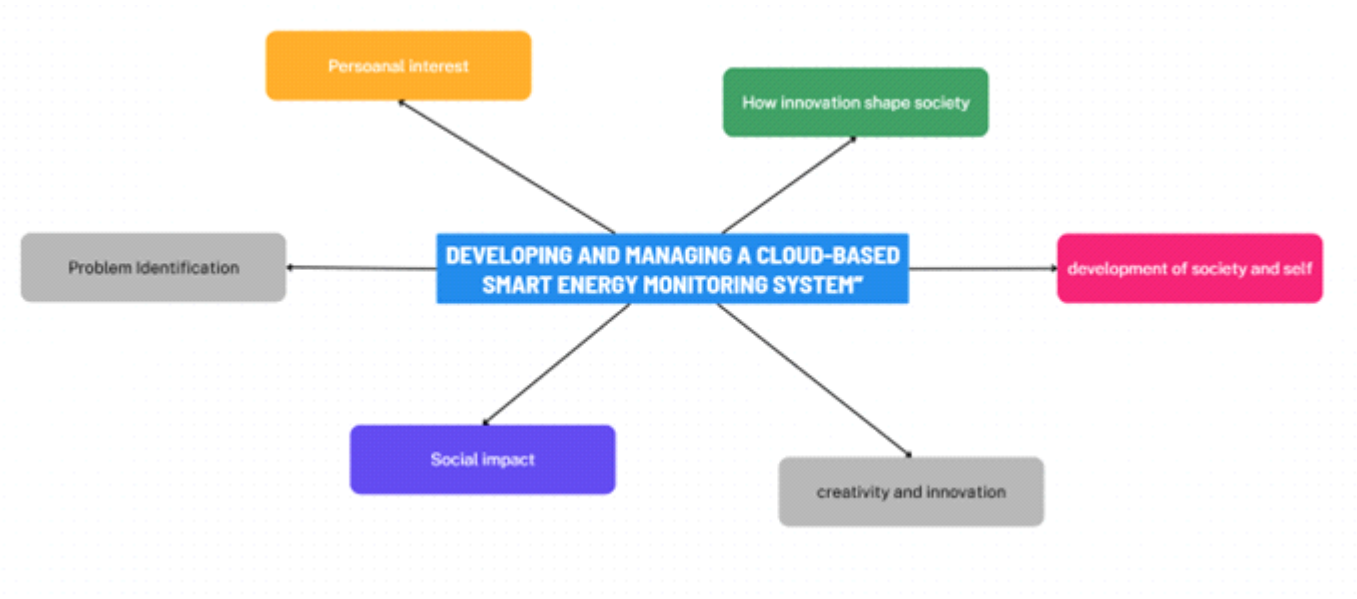
E-Portfolio Link

https://sites.google.com/view/taishee-porfolio/home

Mind Map

Wednesday, March 4, 2026 2:38 PM



Ideation and Mind Map Explanation

Wednesday, March 4, 2026 2:45 PM

Innovation and creativity are the key factors in defining modern societies and advancing their technological progress. Innovation may be referred to as the act of converting the innovative ideas into working solutions that enhance products, services or systems. When applied to address real-life challenges, the use of new technologies can become a source of innovation in the field of computing, including artificial intelligence, machine learning, and data analytics [1]. Baregheh et al. [2] define innovation as a multi-stage process where organisations turn ideas into new or even better products, services or processes as a means of competing successfully in the market. On the same note, McDermott and O'Connor [3] define innovation as an organisational process that is long-term and will entail continuous learning and experimentation.

Innovation has been seen to shape society especially in the energy and environmental sustainability sector. In the last ten years, the digital technologies have been very influential in the way students acquire knowledge and access learning materials. Smart meters, IoT-based monitoring devices, and cloud computing platforms have helped increase efficiency, reduce operational costs, and promote sustainable energy usage [4]. The application of artificial intelligence and data analytics to process large volumes of energy data is becoming more popular, where real-time data are analysed and used to optimise energy distribution and consumption patterns [5]. These technological advances reveal the potential of computing innovation to advance sustainability, efficiency, and intelligent resource management in modern infrastructure systems.

Personally, one finds the field of computing interesting especially in the fields of artificial intelligence, natural language processing and web-based software development. These domains give a chance to develop smart digital systems that are able to analyse information and assist the decision-making of human beings. Artificial intelligence is significant in particular since it will allow computers to work with large volumes of data and create valuable insights that will be able to assist users work on difficult problems. Being a student of computing, researching about these technologies is a chance to acquire technical knowledge besides helping to create innovative solutions that would be of help to the society.

The other hurdle that has been encountered by inefficient monitoring and management of energy consumption. Energy usage data is often fragmented, manually recorded, or not analysed effectively. This can lead to energy wastage, high electricity costs, equipment overload, and increased carbon emissions. Additionally, the lack of real-time monitoring and predictive analysis makes it difficult to identify abnormal energy usage patterns or system faults. These challenges highlight the need for intelligent systems that can collect, analyse, and visualise energy data efficiently [6].

Resting on these challenges, a number of potential project concepts were discussed, such as a smart home automation system, an IoT-based power consumption tracker, a renewable energy optimisation dashboard, and a predictive maintenance system for electrical equipment. All of these concepts are aimed to provide a better learning experience to the students with the use of computing technologies. Having considered these concepts, the project, which will be developed further, is Developing and Managing a Cloud-Based Smart Energy Monitoring System

The suggested system will assist students with such smart functions as real-time energy consumption monitoring, cloud-based data storage, automated usage reports, predictive

analytics for energy optimisation, and interactive dashboards for visualisation. The technologies that can be used to implement these capabilities include IoT sensors for data collection, cloud computing platforms for data storage and processing, machine learning algorithms for predictive analysis, and web-based interfaces for system management.

The system may be expanded in more sophisticated technology platform in the future to include mobile applications, real-time alert systems, renewable energy source integration (such as solar panels), and AI-driven demand forecasting models. These developments can contribute to the broader transformation of smart cities and digital infrastructure, creating intelligent energy ecosystems that adapt dynamically to consumption patterns and environmental conditions. These developments may form part of the overall revolution of digital education, as they establish the smart learning spaces that follow the needs of specific students.

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Wednesday, March 4, 2026 3:39 PM

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Aim and Objectives

Wednesday, March 4, 2026 2:38 PM

The idea that is to be developed in the proposed project is the creation of a Cloud-Based Smart Energy Monitoring System. This project is intended to design and create a conceptual prototype of a Smart Energy Monitoring System to support real-time energy consumption monitoring and management

To realize this objective, a number of objectives have been outlined.

1. To explore the current literature and technology regarding the Smart Energy Monitoring System.
2. To examine some of the issues that are usually encountered by companies in handling Energy Monitoring System.
3. To create a conceptual architecture of a system of Energy Monitoring System that employs technologies like cloud-based data storage, automated usage reports, predictive analytics for energy optimisation.
4. To list and consider the possible features of the system, as well as automated reporting, predictive analytics, and interactive dashboard visualisation.
5. To determine the possible advantages and drawbacks of the adoption of cloud-based smart energy monitoring system in residential and organisational environments.

Research Philosophy

Wednesday, March 4, 2026 5:36 PM

To execute the proposed project, a relevant research philosophy has to be embraced in order to adequately explore it. Research philosophy can be defined as a collection of beliefs and assumptions used as a guide to the way of how knowledge is gathered, perceived, and interpreted during the research [1].

In this project, pragmatic research philosophy is the most appropriate. Pragmatism is dedicated to finding an answer to practical problems through integration of varying research methods to control the attainment of useful results. [2] The philosophy suits well with the computing and technology-related projects since it enables the researcher to use both theoretical information as well as practical experimentation to implement the innovative solutions.

The pragmatic approach focuses on the significance of determining real-life issues and coming up with practical solutions that can be applied in real life [3]. The issue that was considered in the case of this project is the challenge and difficulty in the adoption of cloud-based smart energy monitoring system. A pragmatic philosophy will lead the research to develop a technological solution with the capacity of enhancing the efficiency of learning by utilizing the concept of cloud-based smart energy monitoring system.

Also, pragmatism advocates mixed methods research, which involves integration of both qualitative and quantitative research methods, where it would be required [2]. To learn the challenges and expectations of student learning, qualitative data can be applied, whereas the effectiveness of AI-based learning tools can be assessed with the help of quantitative analysis. This versatility has rendered pragmatism a common philosophy in information systems and computing research.

Search Tools and Research Databases

Wednesday, March 4, 2026 5:36 PM

The most important aspect of the research process entails the identification of the pertinent academic literature concerning the project topic [4]. To make sure that only credible and quality sources of research are referred to, a number of academic search tools and databases will be used.

Google Scholar will be one of the main search engines that will be employed in this study because it has a variety of academic articles, conference papers, and theses related to the topic under investigation. Google Scholar helps a researcher to find influential publications within the area of Cloud-Based Smart Energy Monitoring System, in the shortest period of time.

Moreover, peer-reviewed research articles on the topic of Cloud-Based Smart Energy Monitoring System, machine learning, and software development will be found in specialised academic databases, including IEEE Xplore and the ACM Digital Library. These databases are well established within the world of computing and offer access to quality research that has been published by the major technology organisations.

ScienceDirect is another helpful source of finding relevant literature since it has academic publications in the area of computer science, data science, and educational technology. The multiple research databases will make sure that the literature review will encompass a wide spectrum of views and not use one source of information.

In order to find appropriate research, special search strategies and keywords will be applied. They involve such search terms as “Cloud-Based Smart Energy Monitoring System,” ”Cloud-based data storage,” and “predictive analytic”. The search results will be refined with the use of such operators of the Boolean type as AND, OR, and NOT to select the most relevant studies.

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Wednesday, March 4, 2026 5:36 PM

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Strategies to Enhance Validity, Reliability, Generalisability, and Ethical Considerations

Wednesday, March 4, 2026 2:38 PM

In case of research associated with creation of Cloud-Based Smart Energy Monitoring System, it is necessary to make sure that the results of the research process are accurate, reliable, and ethically responsible. Within the research methodology, a number of measures can be taken to improve the research results in terms of quality and credibility.

Validity is a notion that describes the level of measurement or investigation of the research on what the research aims to study [1]. To increase validity in this project, the research questions and survey instruments will be properly designed to be narrowed down to the learning issues that learners in universities face. The survey questions will be guided by themes that will be discovered in the available literature pertaining to artificial intelligence in education and student learning behaviour. The pilot study prior to the entire data collection process will also assist in enhancing validity as it will be evident that the questions are open and applicable to the research objectives [2].

Reliability is the consistency of the research findings when utilizing the same methods and similar conditions [1]. The reliability will be gained with the help of a structured data collection technique, including a standardised survey questionnaire that is sent by several participants [3]. The research employs the similarity of questions and procedures to guarantee that the findings can be replicated and compared between various participants.

Generalisability is the degree to which the results of a research can be transferred to a larger population that the sample serves [4]. In this project, the question of generalisability will be enhanced as results will be gathered among students of different courses and academic levels and not only among one group of students. The research will mainly involve university students but, the research findings can also be applicable to other institutions of higher learning experiencing the same learning issues.

Responsible research is also an aspect that incorporates ethical considerations. The subjects who will take part in the research will be made aware of the research objective and will give their voluntary consent. No personal identifying details will be gathered and the information will be utilized on the academic grounds. The subjects will also be able to come out of the study anytime they wish. Anonymity and confidentiality will be provided to ensure that ethical considerations are upheld and privacy of the participants is not violated [5].

Research Strategies and Data Collection Methods

Wednesday, March 4, 2026 6:02 PM

To explore the management of Cloud-Based Smart Energy Monitoring System, the selection of the relevant research strategies will have to be made. In the given project, the data collection will involve a survey-based approach that will be applied in order to collect information about the energy consumption practices of households and organisations, existing monitoring systems, and awareness of smart energy management technologies.

Surveys have become popular in educational and computing research since it enables a researcher to gather data of a relatively large population in an easy and organized manner [6]. The questionnaire will be created to collect data concerning current energy usage patterns, challenges in monitoring electricity consumption, cost-related concerns, awareness of smart meters and IoT devices, and willingness to adopt cloud-based energy monitoring solutions.

A pilot study will be done on a small group of students, usually three to five students before the complete survey is handed to them. The pilot study will be done to ensure the clarity and effectiveness of the questionnaire is tested [2, 7]. The participants will be requested to give feedback on the relative questions regarding energy management practices and technological capabilities.

Depending on the feedback of the pilot study the questionnaire can be reformulated to be more precise, eliminate questions that are too casual, or to incorporate other questions that are more relevant to cost-effectiveness of cloud-based monitoring systems. A large group of the participants will then be sent the final copy of the questionnaire. The question and feedback of the pilot survey will be contained in the appendix part of the proposal.

Quantitative and Qualitative Data Analysis

Wednesday, March 4, 2026 6:02 PM

Quantitative and qualitative method of data analysis can be applied in studies concerning computing and educational technology to provide information about the research issue.

Quantitative analysis is the analysis of numerical data aimed at determining patterns, trends and statistical relationships [8]. The quantitative data in this project might be provided by the answers to the survey questions which are measured and completed in the form of rating scales, e.g., Likert-scale questions. As one example, the respondents can be questioned about how helpful they think a Cloud-Based Smart Energy Monitoring System, might be when it comes to increasing their revision efficiency. Descriptive statistics like percentages, averages, or simple graphs can then be used to analyse the results so as to find general trends in responses.

On the other hand, qualitative analysis is concerned with non-numerical data, i.e. written responses or open-ended survey questions. Such an analysis enables the researchers to get deeper into the experiences and opinions of the participants [8]. The common themes within the responses can be identified through the thematic analysis, i.e., IoT devices, willingness for the adoption of cloud-based energy monitoring solutions.

The integration of quantitative and qualitative analytical approaches will enable the study to build closer to comprehending issues in the case of energy management practices and technological capabilities. [9].

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Wednesday, March 4, 2026 6:02 PM

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Pilot Survey Questions

Wednesday, March 4, 2026 5:57 PM

- What are the main parts of a smart energy monitoring system?
- How can energy usage data be stored safely in the cloud?
- What role do smart meters and sensors play in such a system?
- How can simple data analysis help reduce energy waste?
- What steps are needed to keep a cloud-based energy system running smoothly?