Middlesex University Mauritius

2023 Research Symposium

Empowering Communities through Knowledge Sharing

Book of Abstracts

4th March 2023

Message from the Campus Director

Dear colleagues, students and research collaborators,

It gives me great pleasure to extend a warm welcome to all of you to the 2023 Research Symposium: Empowering Communities through Knowledge Sharing. It is always an honour to host this gathering of brilliant minds from across our MDX community and to hear more about your research findings.

This symposium is a celebration of the spirit of academic inquiry and the pursuit of knowledge, and it is a platform to showcase your research. It is also an opportunity for us to come together and exchange ideas, insights, and experiences that can help us in our quest for a better and brighter future. The theme of this year's symposium, "Empowering Communities through Knowledge Sharing," is timely and relevant. It reflects our commitment to using research to address the challenges facing our society and to promote a better understanding of the world around us. We believe that by sharing knowledge and empowering communities, we can create positive change and make a difference in people's lives.

I am confident that this symposium will provide a unique and valuable learning experience for all of us. It will enable us to expand our horizons, challenge our assumptions, and develop new perspectives on the world. I encourage everyone to actively participate in the sessions, engage in meaningful discussions, and network with colleagues and peers.

Finally, I would like to extend my gratitude to all the participants and the Research and Knowledge Transfer Committee who made this symposium possible. Without your support, this event would not have been possible. I wish you all a productive and enjoyable symposium and hope that you leave this gathering inspired and enriched with new ideas and knowledge.

Prof. Mari Jansen Van Rensburg
Campus Director
Middlesex University Mauritius

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Comparing Public and Legal Professional Views of the Criteria for Identifying Credible Expert Forensic Witnesses

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A review of the literature on forensic evidence admissibility revealed there is no single test or protocol in the UK criminal justice system for selecting expert forensic witnesses and as such the English courts may be privileging the wrong types of criteria for admitting forensic expert opinion evidence. With such a lack of unified thinking amongst legal professionals on how to select credible experts, it is highly questionable whether conventional admissibility standards and court safeguards provide jurors and judges with the kinds of information required to rationally assess expert opinion evidence presented at criminal proceedings—this accentuates the need for valid and reliable markers for expertise to be identified. Conversely, there is a body of psychological literature suggesting cognitive processes such as problem-solving ability, memory recall capacity, judgement and decision-making, and proficiency are indicators of general expertise. Adopting a deductive approach, the review of the legal and non-legal literature initially identified 22 proxies typically used by legal professionals for admitting/instructing expert forensic witnesses. These factors were grouped into five broad categories namely: knowing-that, integrity, presentation of testimony, knowing-how, and decoy. The current study set out to determine which factors legal professionals and members of the public believed were the most important for identifying credible expert forensic witnesses. Based on the proxies identified, the researcher devised a 23-item questionnaire and surveyed legal professionals (n = 60) and members of the UK (n = 109) on their importance as indices for being a credible forensic expert. Responses were analysed through Independent sample t-tests, Principal Component Analysis (PCA), Logistic Regression Analysis, and Qualitative Content Analysis. The findings revealed 'expert independence' was the most important proxy across both groups, 'Reliable evidence' and 'relevance of the evidence to the legal question' were of successive importance to the legal group, whilst 'relevance of the evidence' and 'transparent testimony' were of proceeding importance to the public group. PCA revealed four dimensions—legal epithet for expertise; communicating knowledge and integrity; court experience and standing, and; competency and proficiency. The Odds ratio revealed 'practical experience' and 'whether the forensic witness had been subject to criticism at a previous court hearing' as being associated with an increased likelihood of being valued by the public group, whilst 'domain of expertise' was associated with an increased likelihood of being valued by the legal professionals.

Keywords: English Admissibility jurisprudence; forensic experts; credibility.

Structuring a Model for Teaching and Learning in Private Higher Education Institutions in Post Covid Mauritius

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Overview

During the COVID-19 pandemic, most Higher Education Institutions (HEIs) across the globe moved towards "emergency online education", experiencing a metamorphosis that advanced their capacities and competencies as never before. Learning as a developmental process is the central consideration of effective higher education. As a Small islands Developing State in the middle of the Indian Ocean, Mauritius has a similar fate with public and private higher education institutions trying to deliver courses smoothly to students. Indeed COVID-19 has highlighted the transformative power of institutional planning and continuity, investments in technological infrastructures and the imperatives of organisational resilience, flexibility and evidencebased decision-making. Higher education institutions are at crossroads and must decide whether to transform into new kinds of entities. Transformation here is not only in respect of the curriculum, mode of learning delivery, student support and research. It is more holistic and encompasses the operating model, the technology and basically the sum of capabilities that reside in the institution (HEC, 2022). However, on a macro-level, Pérez-Sanagustín et al. (2022) argues that the competencies that HEIs could help develop, focusing on teachers', students', and managers' development, have mislead aspects such as leadership, organizational processes, and infrastructures. Purpose Grounded on a synthesis of existing models, literature, and research on the topic, the aim of this study would be to propose a model to sustain the transformation of private Higher Education institutions in Mauritius. The purpose of this study would not be to override the actual existing models but act as a supplement for stakeholders such as educators, educational policymakers and students to refer to in general for enhanced decision-making.

Methodology

The methodology proposed would be interviews with national and international experts in learning and higher education offering the latest thinking on university learning. A science of learning lens will applied during development, threading together the often-disparate thinking in education, neuroscience, and psychology, to offer a convergent model on effective learning in higher education. The model will be evaluated with Private Higher Educations in Mauritius and will be used for analyzing the transformation of their teaching and learning practices during the pandemic lockdown.

Expected results

The proposed model could infact act a model that can be adopted in its entirety at an organisational or faculty level.It could also be used on an ad hoc basis to inform the decisions that impact student learning as well as for identifying teaching and learning competencies addressed by private higher education institutions, their deficiencies, and their strategic changes. At an individual level, the

proposed model will be useful to teachers to reflect on their current practice, finding affirmation for the excellent teaching that is already occurring in the higher education sector, and identifying priority areas for growth and change.

Keywords: COVID-19; Higher Education; Mauritius.

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Investigating Attentional Bias to COVID-19 related Anxiety

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Purpose: The general rise in state anxiety associated with the COVID-19 pandemic has been linked to attentional biases towards negative stimuli. It was therefore important to understand the mechanisms of attentional biases towards COVID-19 related stimuli to improve mental healthcare policies and interventions.

Methodology: 122 participants from Middlesex University, screened free of any clinical diagnoses, participated in a lexical dot probe task which recorded their reaction times in milliseconds, whereby attentional bias levels were calculated. A 2 (Anxiety Levels: High Anxious, Low Anxious) x 2 (Lexical Stimuli Type: COVID-19-Related; Neutral) mixed factorial ANOVA was used to assess the effects of anxiety and COVID-19-related or neutral stimuli.

Findings: Results showed the presence of an attentional bias in participants towards COVID-19-related stimuli. An interaction effect was also found such that highly anxious individuals showed a greater attentional bias towards COVID-19-related stimuli compared to low anxious individuals.

Implications: A follow-up study is being run to test the effectiveness of attentional bias modification training through dot-probe task in reducing anxiety. The findings of these studies can be extrapolated to clinical settings to better inform mental health interventions addressing attentional bias.

Keywords*:* COVID-19; attentional bias; anxiety.

The Effect of Digitalisation on Higher Education Outcomes in Middlesex University Mauritius

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Global pandemic, specifically, COVID-19 has not just drastically changed the operating models of several institutions including Higher education systems, but it has resulted in showing the weaknesses and failures of many institutions worldwide (Amankwah-Amoah, Khan, Wood, and Knight,2021). These changes necessitated the introduction of digitalisation in the educational sector to prevent the stop or complete closure of the educational system. Digitalization is the partial or complete conversion of institutional approach and activities to emerging technologies such as Video-conferencing platforms, the Internet of Things, cloud technology, robotic systems, mobile phones, and machine learning (Amankwah-Amoah, Khan, Wood, and Knight,2021).

The study determines the effect of digitalisation on student outcomes in the Mauritius Higher Education system. Specifically, the study determines the effectiveness of digital technologies/tools in the delivery of education services, during COVID and post-COVID, determines the effect of digitalisation on the performance of students, investigates the challenges faced by students in getting quality education services using digital technologies/tools, examines the impact of Covid-19 on online education service in Mauritius and determines students' perception of Online learning. Data for this study was generated using structured questionnaires that was administered to 100 students in Middlesex University using random sampling technique. The analysis of the data was done using descriptive and inferential statistics.

The study shows that digital technologies and tools were not effective in the delivery of education services during Covid, shows that there was no significant improvement in the students critical and analytical skills resulting from the technology used, identifies that the pandemic caused major changes in the lives of students causing anxiety, mental stress and thus students lacked motivation for online classes, reveals that the pandemic had a great impact on online education service delivery and identifies that students did not enjoy online learning as compared to physical learning.

It was concluded that digital technologies did not enhance lecturers teaching skills as students preferred to interact with their lecturers physically rather than online. Ensuing from lack of face-to-face interactions with their course mates, the students agreed that they did not collaborate better with their course mates using digital technologies. The use of Kortext as a digital technology in the provision of online education service delivery to students at Middlesex university allowed for easy access to course materials.

Keywords: Digitalisation; Covid-19; higher education; student outcome.

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Amankwah-Amoah, J., Khan, Z., Wood, G. and Knight, G., 2021. COVID-19 and digitalization: The great acceleration. *Journal of Business Research*, *136*, pp.602-611.

The Right to Freedom of Thought in Mauritius

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Section 11 of the Constitution of Mauritius provides that no person shall be hindered in the enjoyment of his or her right to freedom of conscience. This section explicitly incorporates the right to freedom of thought, together with other internal and external aspects of the right to freedom of conscience. As this section is couched in terms similar to that of a qualified right, it would seem that the right to freedom of thought can be limited under certain circumstances as long as the restrictions are lawful, proportionate and reasonably justified in a democratic society. However, the right to freedom of thought is generally regarded as an absolute right. In this respect, it is important to first sketch the outlines of the right to freedom of thought as a constitutional or fundamental right from a comparative law perspective. For instance, comparing the right to freedom of thought with its equivalent under the European Convention on Human Rights will shed light on how it should be construed in the Mauritian context. This is because Chapter 2 on Fundamental Rights in the Constitution of Mauritius has been largely modelled on the European Convention. Second, it is important to note that the contours of constitutional rights in Mauritius have rarely been delimited by the courts. While the judiciary has made large and innovative strides in delivering better access to justice to Mauritian citizens, there has nonetheless been a contumelious disregard to recognising and enforcing the constitutional rights of citizens by the courts. It is hard to resist the conclusion that this may be so because of a lack of a human rights culture and a long history of judicial conservatism. Finally, the applicability of the right in the contemporary context contemporary context of political speech, technology, surveillance etc will be examined, with recommendations for reform in this area.

Exploring the Influence of Love through Teacher Caring on Students' State Motivation

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Many people express discomfort at the invocation of love with regards to teacher- students relationship (Aldrige, 2019). However, according to Freire, education is actually an act of love which can lead to the construction of a better world (Schoder, 2011). Geoff Hinchcliffe (2006) further posits that learning from others and teaching others are indeed expressions of love towards others. Many theorists believe that teachers should express a caring love, an agapic love towards their students (Lawrence, 1970; Gardner, 1956; Manning- Morton, 2006; White, 2016; Anderson, 2002; Freire, 1970; Liston, 2000; Keith, 2010; Daniels, 2012; Darder, 2015; Zembylas and Lanas, 2015) and research studies have shown that caring teachers have a positive impact on the learning outcomes and motivation of students (Battistich et al.,1997; Witt et al., 2004; Wilson, 2006; Cornelius- White, 2007). Still, for long beating, humiliating students and the 'carrot and stick' theory have been used to urge students to learn (Orwell, 1981; Kohn, 2000; Linn, 2003). Yet, according to Noddings (2006), this motivational approach can lead students to use questionable methods of compliance such as cheating. Instead, caring should be the essence of education (Smylie, Murphy & Louis, 2016). But still, the current conception of caring in education is constructed from the perspectives of teachers and school leaders, rather than the students themselves.

Hence this study aimed at giving voice to the students to explore how they characterize teacher love and care and its influence on students' state motivation to learn in class. Students' state motivation refers to their motivational condition for a specific learning situation such as a particular class, task or content area (Brophy, 1983). The following research questions were addressed: a) How do Mauritian students describe and characterize teacher love? b) From Mauritian students' perspective, what are the behaviours and virtues displayed by a caring teacher? c) To what extent does teacher caring influence students' motivation to learn?

A small- scale and short term two-cycles action research with a qualitative approach was carried out. Strategies of teacher love and care inside and outside the classroom were implemented during a time period of two months. The first cycle which aimed at answering the two first research questions was diagnostic research whereby face to face semi-structured interviews were conducted with ten students individually. The findings were then used to inform the second cycle which was experimental action research. Subsequently, the ten students' state motivation to attend classes and learn were probed through a self-reported questionnaire.

It was found that, conversely to some theorists (Chabot, 2008; Cloninger, 2008), the students did not differentiate between teacher love and care. The students associated teacher love and care with academic support, warm teacher- students relationships, emotional and social support, tough love, discipline and fairness. A close similarity was observed between the students' characterization of teacher love and care and theorists' recommendations on how to develop loving and caring

relationships (Chabot, 2008; Underwood, 2008; Noddings, 2012). It was also found that teacher love and care have several positive influences on the learning process of the students. During the second action research cycle, it was discovered that while there were other factors affecting the students' state motivation, teacher love and care did positively influence their state motivation to attend classes and to learn.

Keywords: Love; teacher care; state motivation.

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Deep Combination of Radar with Optical & Skeletal Modalities for Gesture Recognition: The Role Of Attention in Intermediate and Late Fusion

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Attention and multimodal fusion are two crucial techniques used in gesture recognition, which involves recognising and interpreting human body movements and gestures. Attention mechanisms allow the model to focus on the most informative parts of the input data, such as joints or body parts, for gesture recognition. Multimodal fusion combines information from multiple modalities, such as visual and radar, to improve gesture recognition accuracy. These techniques have been extensively studied and applied in various domains, including human-computer interaction, robotics, and entertainment. In our work, we demonstrate that the points at which merging, and attention are performed are crucial considerations in multimodal fusion of radar for gesture recognition.

For our experiments all models are implemented on Tesla a P100 16GB GPU under Linux environment. The deep learning models are optimized by mini-batch gradient descent with the Adam optimizer and a maximum number of epochs of 200. We select the hyperparameters which have obtained a minimum loss on the validation set. We also use MediaPipe which is an open-source framework, used for media processing. It is a framework for building machine learning pipelines for processing time-series data. This hand-tracking solution utilises a machine-learning pipeline consisting of two models working together. A palm detector that operates on a full input image and locates palms via an oriented hand bounding box and a hand landmark model that operates on the cropped hand bounding box provided by the palm detector and returns high-fidelity 2.5D landmarks.

First, we found that the multimodal fusion of different inputs results in a clear improvement over unimodal approaches due to the complementary nature of the various input modalities. From the eight different architectures in our work, it was noted that late fusion with late attention has the potential of outperforming early and intermediate fusion with all modalities present and in circumstances where one of the modalities is masked. End-to-end late fusion with late attention performs with better accuracy and Jaccard index score when the skeletal modality is missing showing that the architecture surpasses other configurations and leverages that modality.

Keywords: Multimodal; attention; gesture.

Investigating Data Repair steps for EHR Big Data

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This paper builds on previous research with the aim of optimizing data quality methodologies for Big Data systems, with a focus on Electronic Health Records. This optimization is performed for organisations aiming to follow a data-centric data quality strategy. One of the most important stages of a data quality lifecycle is involved with correcting dirty data detected. There is a lack of knowledge relative to the performance of existing data repair algorithms and tools in a Big Data context. This study performs a systemic review of data repair algorithms and tools, subsequently undertaking an experiment-based approach to evaluate those algorithms and tools while comparing it with a prototype built based on the results of a previous study. While some algorithms and tools could be seen to be marginally better than others, there was no algorithm or tool which was seen to be extremely adequate in the Big Data context. Thus, recommendations of improvements needed for data repair algorithms and tools for Big Data are given.

Keywords*:* Data quality; big Data;, data repairs*.*

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Presenting Reflections on the Effectiveness of Student-led Academic Skills Workshops based on Anecdotal Account

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The purpose of this reflective paper is to critically discuss the effectiveness of student-led Academic Skills workshops delivered using structured resources that support a constructivist approach to learning academic skills (Evans, Henderson and Ashton-Hay, 2019). The paper highlights the effectiveness of student-led workshops when a structured session of specific objectives, activities and defined outcomes are applied gaging 'deep learning' of academic skills empowering students for their study life and beyond. While the constructivist model is known for fostering engagement from students, its application from a student perspective contributes to enhancing the active learning experience of academic skills. The learning environment is created from a student's perspective, further facilitating the construction of meaning for the student participants. Students are likely to benefit from the co-operative learning setting and participate in meaningful discussions. This paper presents reflections from a student facilitator and the mentor based on anecdotal accounts following the Brookfield's reflective model framework and is intended to feed future research studies involving collection of data from students who attended academic skills workshops led by the student facilitator through focus groups.

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Consumer Sentiment Analysis Comparison between Air Mauritius and its Main Competitor/s based on Online Reviews

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With the advent and rapid development of online platforms, it has become very common for airline passengers to share their flight related experiences on social media and travel specialised websites such as TripAdvisor and Skytrax. Thus, applying natural language processing techniques such as sentiment analysis and topic modelling provide airlines with the possibility to gain insights about the most prevalent discussion topics, sentiments and opinions expressed by customers in online reviews. In terms of methodology pertaining to this paper, it can be divided in to three main sections, methods used for sentiment analysis, topic modelling and identifying the main competitors of Air Mauritius. Sentiment analysis included methods such as data collection and labelling, text pre-processing, vectorization, sentiment classification and classification evaluation. Similarly, topic modelling and competitor identification involved a number of methods (steps). For this research work the KNIME Analytics Platform was used to perform analysis. Before carrying out sentiment analysis and topic modelling a competitor identification exercise was performed, whereby Emirates was found to be the main competitor of Air Mauritius. The results of the sentiment analysis process clearly indicated that the consumer sentiment towards Air Mauritius was more negative in comparison to Emirates. There was a difference of 50% in terms of reviews with a negative connation related to Air Mauritius in contrast to Emirates. The topic modelling process uncovered that the main themes of discussion in reviews were related to in-flight services, customer support and cabin. In-flight services were identified as the most popular topic of discussion, with 77% of all reviews in the whole dataset related to this particular theme. Further analysis revealed that the distribution of sentiment polarity across the 3 topics were almost similar for both Air Mauritius and Emirates. One of the major challenges encountered during the course of this research work, was the small dataset size which affected the accuracy of the analysis.

Investigating The Need for a Hybrid Business Model for Social Enterprises in East Africa

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Failing States in Africa are increasingly creating dependence on International Aid and Nonprofit Organizations in the health, education and food sectors. Consequently, the constant reliance on Aid diminishes the responsibilities of their governments and further lead to economic stagnation rather than growth. The initiative of Social Enterprises (SEs) - as community based organizations that aim to solve economic, social and environmental needs of a country - has made an attempt to reduce the dependence on Aid. SEs promote knowledge transfer through training and skills development for the local communities instead of distributing donations and hand downs. It is however alarming that these SEs are commonly failing or rendered dormant in many African Nations.

The problem is that the full potential of SEs in East Africa is yet to be explored as they strive towards achieving the United Nation's Sustainable Development Goals by the year 2030. Change has notably been recorded where SEs in East Africa have achieved community development through social, technological and entrepreneurial innovation. This is however short lived.

The purpose of this research was to investigate the root cause of failing Social Enterprises in East Africa through identifying constrains within their business models. The business model is the focal point of scrutiny because it reveals a 'blue-print' for the strategies to internal and external interactions of an organization while highlighting how value is created, shared and remunerated.

The methodology featured a descriptive research design that targeted 10 SEs in East African countries being; Tanzania, Uganda, Kenya, Rwanda and Burundi. The sampling methods applied were Purposive and Stratified and a total of 120 participants consisting of all stakeholders of the SEs responded to questionnaires and focus groups. The data was analyzed using quantitative techniques of descriptive and inferential statistics.

The findings of research were tied to two recurring issues with the business model of SEs. The first problem is identified in the architecture of the model itself- which seems to inevitably exist in two parallel folds; the social impact model and the profit maximizing model. There is often conflict in managing the financial and social objectives of SEs. The second problem originates in the legitimacy of their existence as a 'for-profit' or 'non-profit' organization. This evidently affects the identity and structure of the SEs in that there is uncertainty towards moral versus pragmatic legitimacy. These two issues have negatively impacted overall decision making, business operations, leadership and management, and additionally paved way to external pressures and demands.

The proposed solution is to develop a Hybrid Business Model to reach equilibrium that simultaneously satisfies both social impact and profit maximizing objectives of SEs. The theories that further inform this study include Contingency Leadership, Resource Based View and Stakeholder Theory.

The value of this research is in its contribution towards studies on Business Models and narrowing the knowledge gap of region specific Hybrid Models in East Africa. Previous findings on this topic largely cover Europe and North America leaving a vacuum in other continents such as Africa. This research has therefore uncovered an interesting solution on how SEs can thrive by balancing their business models. To add on that, this study provides insight on how to possibly restore and strengthen SEs in East Africa which is a paramount step to reducing dependency on International Aid. Further study is underway; developing an experimental research design to test the application of a hybrid business model to SEs.

Keywords: Hybrid Business Model; social enterprise; equilibrium.

An NFC-enabled mHealth App for Hospital Patient Tracking

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Purpose of the Research:
Patient misdiagnosis is a healthcare issue that is quite widespread in hospitals around the world. The problem could happen from incorrect patient identification due to wrong labelling of patient files, or wrong placement of patient data in patient dossiers. It is the duty of hospitals and their staff to ensure that such mistakes are avoided. The near-field communication (NFC) technology, which is a short ranged wireless communication technology, has been found particularly useful in helping to identify patients within hospitals. This paper demonstrates a working prototype to prevent patient misdiagnosis through the implementation a patient healthcare management information system using a combination of NFC technology, web and mobile technologies.

Methodology/Design:
The Rapid prototyping methodology was used to come up with a quick working prototype that could be tested with users. The proposed solution architecture that was developed consisted of the following components:

- NFC bracelets
- An NFC-enabled mobile device
- An Electronic Health Record Management System

The NFC silicone bracelet is scanned by a mobile device that has both the NFC and WLAN wireless communication capabilities. An NFC Tag ID is generated and assigned to each new patient. If it is a returning patient, the particular ID number is retrieved from the electronic health records database residing at the server over Wi-Fi communication. Patient details corresponding to the patient ID are sent back to the application running on the mobile device. The MIFARE Ultralight NFC chip was chosen for its appropriate data storage capacity. A Mobile App was also developed in Android Studio using the Ionic framework with Apache Cordova. NFC Data Exchange format (NDEF) APIs are used to interface NFC devices. Patient data like medication prescriptions, medical tests, appointments, doctor information, diagnosis, visit dates…etc were stored in a MySQL database. A PHP based web application was developed to access and maintain patient records.

Key Findings:
The Technology Acceptance Model (TAM) was chosen for evaluating the acceptance of NFC tag-based mHealth Patient Healthcare Tracking System. The TAM constructs that were investigated were as follows: perceived convenience (PC), perceived ease of use (PEOU), perceived usefulness (PU), attitude towards use (ATU) and continuance intention to use (CIU). 45 medical doctors working in five

major local private medical institutions participated in the testing and evaluation phase. Statistical analysis using SPSS showed an overall TAM score of 4.0, suggesting that the prototype was deemed useful by the medical staff.

RaspiMonitor: A Raspberry Pi Based Smart Home Monitoring System

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Novel technological infrastructure such as smart homes have undergone major developments during recent years. Owing to the numerous benefits brought about by smart homes, research on the topic has been increasing at an exponential rate, bringing quality properties such as security, usability, reliability, and others. Despite their various advantages, smart homes have not been in a positive spotlight regarding security and reliability. The main reason that people are hesitant towards adopting an implemented intelligent system at their domicile is due to the lack of trust they allocate to the electronics. As such, this paper provides insights on an innovative and low-cost smart home monitoring system named RaspiMonitor. While the central aim of the system is to offer a robust smart home architecture which discreetly caters for the safety and security of its environment, it also helps in reducing energy wastage. The RaspiMonitor was carefully designed using dynamic web-based services in addition to an evaluation which quantified its usability and acceptance through the Technology Acceptance Model (TAM) with 6 constructs. Results in principle portray acceptance of the system with a mean score of 4.47. This indicates that a robust hardware and software architecture such as the RaspiMonitor is useful, convenient, and easy to use.

Keywords: RaspiMonitor; Internet-of-Things; smart home.

IoT Based Smart Parking System

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In recent times, the number of vehicles on the road increased, different nations began to develop smart parking systems: SPS is a system that employs technology to properly regulate parking lots. This technology assists automobiles in locating an empty spot by using sensors to detect the status of the parking slots that is occupied or unoccupied and then routing potential drivers to accessible areas. Every day, vehicles waste time, energy, and finances circling parking lots in search of an available parking space. The primary source of this issue has been found as the fact that drivers cannot determine whether there is an available spot without cruising around the parking lot. Furthermore, the prevailing situation of Covid-19 has become a real issue worldwide: the virus can live on metallic surfaces for two days thus, traditional parking system still make use of ticket machine to pay for the parking which make many people at risk. Hence, the aim of this thesis is to solve these alarming problems which people face daily.

The development the prototype adhered to the agile methodology which has provided the successful development of this prototype as a series of steps had been followed: the first stage consists of performing a thoroughly review the literature on existing solutions of SPS to have a better understanding and overview of important aspects of the system and by performing a comparative and critical analysis of existing system to find potential defects and new ideas, planning the physical and logical structure of the system, implementing the prototype on a mock-up using sensors and microcontroller and finally, the evaluation and testing of the different components implemented was performed.

After performing an in depth literature review about the existing solutions, projects that have already been implemented and most importantly, analysing the different parking system found in various places in Mauritius, it was found that these systems are not energy efficient and the need of human intervention was needed to open the barrier systems or for the payment methods and finally divers need to enter the parking space cruise for minutes to find an empty parking lot, thus this IoT based smart parking system has targeted to bring up new innovations such as the integration of smart lighting, a full automated barrier system to access the parking facility and mostly importantly, the development of a mobile application which permits users to view the slot map which provide live status of the occupancy of the slots and also, a payment system has been integrated into the mobile application to enable users to pay for their parking fee. Ultimately, the whole prototype has been passed through various testing phase and an evaluation phase which concluded this prototype can be implemented inside any parking space and has a high level of efficiency and use.

Keywords: Smart parking; parking lots; mobile application;

A Hybrid Model with Web Application: E-Mail Phishing Detection using Deep Learning and Natural Language Processing

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This thesis presents research into methods for identifying phishing emails by examining their contents. Malicious emails can install viruses, spyware, or bots to launch ransomware attacks. Users download/open attachments that look legitimate and spread viruses. Some existing techniques to detect email phishing are User Awareness, Web Scraping, Spam Filter, Multi-Factor Authentication, Extension on browsers, Machine Learning (ML), Deep Learning (DL) and Natural Processing Language (NLP).

The purpose of this research is to use Deep Learning (DL) and Natural Language Processing (NLP) to create a reliable system for identifying phishing emails. The research employed a recurrent neural network (RNN) and a bidirectional long short-term memory (BiLSTM) as the deep learning model, and the term frequency-inverse document frequency method as the natural language processing technique (TF-IDF).

Missing and duplicate values were removed to ensure that the dataset was clean and accurate. Textual preprocessing was also performed to prepare the data for natural language processing and machine learning. These steps were taken to ensure that the model was able to learn from a high-quality dataset and produce accurate results. Additionally, SMOTE was used during pre-processing to balance a small and unbalanced dataset.

In this research, both RNN and BiLSTM models are tested on a dataset containing both phishing and non-phishing emails, and their results are compared. The TF-IDF + RNN model is superior to the TF-IDF + BiLSTM model, with an accuracy of 91% compared to 89%. The study also features a web application that can identify whether or not an incoming email is a phishing attempt. In this thesis, we use a train-test 80-20% methodology with a deep learning model (RNN and BiLSTMs), select features based on the data, evaluate the model, and deploy it. The research makes a contribution to the field of email security by presenting an effective method for detecting phishing emails using deep learning and natural language processing.

Multi-Modal IoT Home Security System with Pressure-Sensitive Mat Sensor

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Internet of Things has given a new opportunity to make home security more affordable, easier to use and configure for everyone. Sensors combined with machine learning algorithms yield remarkable results in identifying intruders from other external factors (Taiwo and Ezugwu, 2021). Nevertheless, those systems are not foolproof. The sensors can be easily triggered due to different environmental and lighting conditions throughout the day, causing false positives (Gonzalez, 2022). Alternatively, even worse, they can be seamlessly bypassed by a skilled burglar. Furthermore, most security systems become ineffective when there is a power outage, thus leaving home vulnerable to burglary (Tholen, 2021).

Therefore, a security system was proposed where the sensors to detect the intruder were placed on the floor. A comparative analysis of the different existing types of sensors was carried out to determine the most appropriate one to be used. The criteria used were facility in integrating the sensor in the circuit, its cost-effectiveness and market availability. The results showed that piezoresistive was the most appropriate. The piezoresistive sensors used were Velostat sheets. Its resistivity changes when pressure is applied to it (Dzedzickis et al., 2020).

The Velostat sheets were then inserted inside a mat with copper wires arranged in columns and row on the upper and lower side of the carpet (Li et al., 2019). This yielded a total of 225 different sensors that could detect pressure intensities at various locations across the mat. This way, the system would detect an intruder as soon as one foot is stepped on the mat, thus making it unavoidable. An investigation was also carried out to determine the best interval between the sensors to provide for a larger surface without losing accuracy. The interval distance tested were 30mm, 50mm and 80mm. As the interval distance increased, so was the sensing area of the mat. The same testing cases were performed on each interval; the most satisfactory results came from the 30mm.

The 225 different sensors on the mat allowed the owner to track the live position of the intruder. A heatmap was designed on a web application so that the location could be represented visually. As an intruder was walking, the position was shown on the heatmap. Furthermore, as soon as the mat detects an object, a camera is activated, and a picture is taken. The latter is passed through a CNN algorithm with the Efficientdet model to detect a human entity. This procedure reduces the number of false positives detected. Then, the system alerts the owner via two communication channels: email and SMS. The system is also equipped with a battery to keep the device up even if there is a blackout. Finally, each intrusion and blackout are recorded on an online database, accessible via the web app, for future reference.

The proposed concept was then compared against existing security systems, like Ramli et al. (2021), Taryudi et al. (2018) and others. It outperformed them in terms of being non-intrusive to the owner, resistant to blackout, providing a tracking feature for the intruder and not being bypassed or fooled easily.

Keywords: IoT; security; Piezoresistive sensor;

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Blockchain dApp for the Medical Sector

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The healthcare sector has always faced a plethora of challenges and a switch to modern systems promised to solve most of the issues present at the time; this promise that was not fulfilled and created other problems onto the existing ones. Existing Electronic Health Records (EHR) and Electronic Medical Records (EMR) are archaic and lacklustre in terms of interoperability, security, uptime, efficiency, record keeping, trustworthiness and accountability. This project's core is a hybrid blockchain and the goal is to use its inherent properties to solve the aforementioned gaps identified. The blockchain will use consensus mechanisms paired with cryptography while also having well thought out permissions to ensure that the stored data is secure, private, and accessible only by those with the authority. The decentralized nature of the blockchain will be an added layer of security preventing downtime while the immutability of the blockchain will ensure that the records are not tampered with. Each transaction will be accompanied with the signature of the author of the transaction as well as the timestamp for when the transaction was carried out. Transparency between patients and medical practitioners will be attained, preventing the prescription of clashing treatments in case a patient searches for a second or third opinion. In order to increase the efficiency of the system and also give the users authority over their medical data, the system will be developed through a cross platform mobile application which will allow for seamless and near instantaneous transfer of medical data, viewing of medical documents, creation of invoices as well as editing of permissions relative to data access. The application will also cater for emergency scenarios where the patient is unresponsive by displaying crucial details such as emergency contacts, allergies, underlying health conditions in order to help out paramedics or registered first aiders. Third party authorities will no longer be required since smart contracts will be used, hence increasing efficiency as well as accelerating data access.

As for expected findings, the evaluation will be user based and performed using the Unified Theory of Acceptance and Use of Technology (UTAUT) model with at least 5 constructs (Performance expectancy, Effort expectancy, Perceived security risk, Perceived trust, Technological awareness); the purpose of this model will be to determine and predict the behavioural response of the potential users. Once complete, a secure and trustworthy and efficient platform for medical data will be available, a significant drop in fraudulent medical activities should be recorded and patients will finally have authority their medical data.

The most significant limitation for this project is its cost; the Ethereum blockchain has been identified as the blockchain to host the service and it can be quite costly. Certain individuals would prefer to have access to their medical data via a computer instead of a mobile device and the language used for the cross platform mobile app (Flutter for Dart language) currently does not have proper support for such a task.

Keywords: Blockchain; decentralized electronic health records; cross-platform decentralised app