

Smart Energy Meter Project

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Energy meter billing is an important part of energy distribution. The use of manual systems is undesirable. Due to human errors at utility companies, it is a problem for users to get them corrected; that is, customers have to stop over at the company offices, stand in a queue and get them corrected. There is a need to improve the accuracy of the bills. To avoid human intervention in the billing process, an automatic reading meter system can be used. Currently, those imported into the country can only measure and monitor electricity but do not allow remote access. The other problem with the system is that it requires a lot of manpower; it is time-consuming and prone to errors. "Smart energy meter" can solve these issues by providing services to the consumer

through SMS along with other inbuilt features such as tamper-proof, fault detection, etc. The energy meter utilizes a GSM module to monitor energy consumed by the authority.

Similarly, the utility company can use the GSM service to send feedback. The GSM technology used enables the consumer to receive messages about the consumption of power (in KW), and when low, it automatically alerts the consumer to recharge. This technology holds good for all electricity distribution companies, private communities, IT parks and self-contained housing projects. The implementation of this project will help in better energy management, conservation of energy and in doing away with the unnecessary hassles of incorrect billing. The billing system will keep track of consumption and solve any disagreements on consumption and billing.

Electricity theft is also a common issue. The main
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By: Rebecca Richard

EDITOR'S NOTE



We welcome you to our May edition.

Stakeholder engagement plays a pivotal role in considering the needs of every key public associated with an organisation. This is a fundamental aspect that the University does not take for granted.

In this publication, we feature stories of BIUST joining hands with several institutions in an endeavor to push its mission forward, as well as partnership and collaboration that accords it to grow while achieving shared goals. This edition also featured the recent stakeholder meeting that the university organised.

I am particularly thrilled by the research by the Electrical, Computer and Telecommunications Engineering department on the smart energy meter for automatic metering and billing system. This system that uses the integration of a micro-controller and GSM short message service (SMS) provides the meter reading system with automatic functions that are predefined. This department successfully produced its inaugural PhD graduate, Dr Duncan Dauda. Let's hear what the new kid in the block researched on.

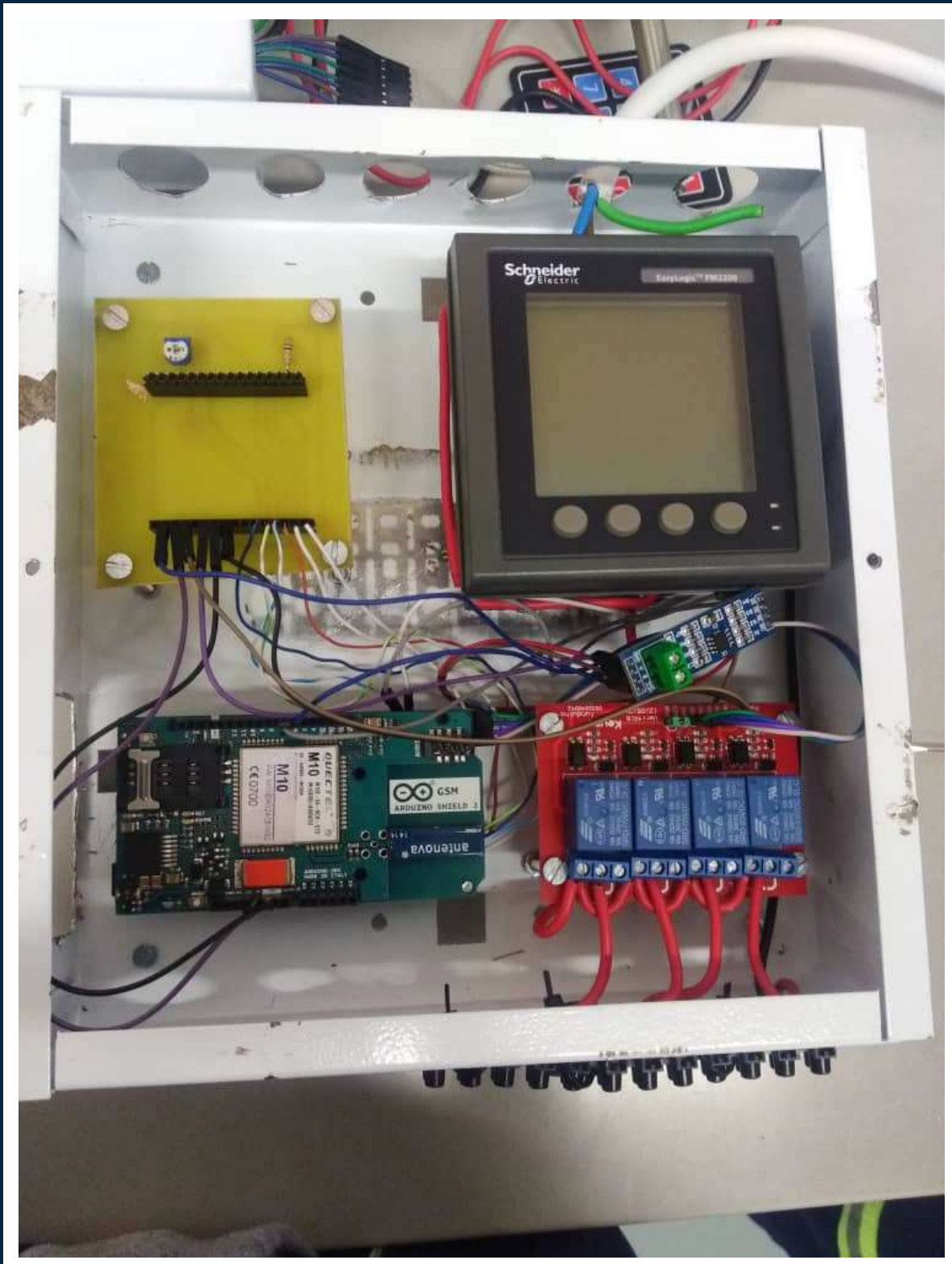
Lastly, let me thank all those who made this publication a success. I therefore urge you, colleagues and students, to continue supporting us by giving information on your research, publications and general projects. If you want to contribute or talk to us, please send an email to barutir@biust.ac.bw or gachalaw@biust.ac.bw

Continue adhering to COVID-19 health protocols and be safe!

disadvantage of the 'ordinary' meter is that it is less reliable, less accurate and non-tamper proof. Even the present-day electronic energy meters are not completely tamper-proof. The proposed energy meter has features of detecting faults in the distribution system, which is done by checking the status of supply at a distribution transformer.

Smart meters are the future because they have vast merits for both the consumers and the producers or

suppliers. The main aim is to make the smart meters locally thus improving the number of electronic gadgets manufactured or made locally. The smart meters will, therefore, be able to counteract if not all, most of the demerits of the 'ordinary' meters, for instance; it must allow for remote access and be user-friendly, hence indicating if the amount of electricity used is high or low which leads to regulations and in turn saving energy. A microcontroller and the contactor will be the heart of the design.



Award of UNESCO Chair on Advanced Manufacturing (UCAM) to BIUST

The Botswana International University of Science & Technology (BIUST) has been awarded the UNESCO Chair on Advanced Manufacturing (UCAM), which is held by Associate Professor E. O. Olakanmi and hosted in the Department of Mechanical, Energy & Industrial Engineering (DMEIE) of the Faculty of Engineering & Technology. UCAM, whose activities comprise of both teaching and research will:

- (i) train 40 industry-ready postgraduates within the four years (2022 to 2026) of project implementation.
- (ii) update the advanced manufacturing (AM) Masters curriculum.
- (iii) develop a unique African e-learning platform for AM instructional delivery and innovating AM training equipment, frames for drones and satellites, radiation shields and medical implants; as well as
- (iv) promoting science, technology and innovation for peace and sustainable economic development.

UCAM has an inter-disciplinary team that draws from the knowledge and expertise of the Advanced Manufacturing and Engineering Education (AMEE) research group (led by Associate Professor E. O. Olakanmi), the Applied Nuclear Science and Technology (ANST) research group (led by Professor G. Hillhouse), the Applied Radiobiology (ARB) research group led by Dr. D. Nkwe; and the Mining Centre directed by Dr. B. Matshediso. Other members of the UCAM team include Dr. O. Matsebe, Dr. M. Mosalagae, Dr. K. Orapeleng, and Dr. Prasad Raghupatruni

The AMEE had researched on AM for equipment repair and design/fabrication of metal powder atomiser in collaboration with the Council for Scientific and Industrial Research/Laser Enabled Manufacturing research group (CSIR/LEM) in South Africa. Since 2016, Prof. Olakanmi has been coordinating the activities of the Education for Laser-based Manufacturing (ELbM: <https://elbmmobility.org/>) consortium. ELbM comprises of Universities from Botswana, Kenya, Nigeria, South Africa and Italy. ELbM combines academic and industrial resources to empower teaching staff to impart postgraduate

students with employable skills in AM corresponding to the needs of industries. Prof. Olakanmi, supported by the AMEE, SMaRT, ANST, SPNS, ARB and the Mining Centre teams, brings in his training, leadership, research and teaching experience, attracting training/research funding, and extensive ELbM network to deliver the objectives of UCAM.

UCAM will engage knowledge domains of laser-based manufacturing (LbM); powder metallurgy; machine design; mechatronics, satellite/drones technology and biomedical engineering to train a critical mass of engineers who transform Botswana into a knowledge-based economy; create avenues for exploitation of LbM technology for job creation in Botswana and enhance the quality of teaching at ELbM institutions. The Chair will deliver its mandates with BIUST making an in-kind contribution of US\$4,286,167 while LEM/CSIR makes an in-kind contribution of availing the Chair and the ELbM partnership with access to her LbM facilities. The Chair is also leveraging on US\$1.67 million which the ELbM consortium has generated in research, training and mobility funding from 2020 to 2024. With BIUST successfully coordinating all fund-raising activities for ELbM partnership, it is anticipated that an additional US\$1.556 million needed for curriculum development and design/fabrication of machines would be successfully obtained by UCAM.

UCAM has adopted the working theme “Botswana Manufactures for Sustainable Development”, with a view to attaining an accelerated industrial development of Botswana, as well as building a solid foundation for technology and innovation. This would lead to the creation of a critical mass of high-level expertise in LbM, powder metallurgy and machine design/fabrication, build institutional, national and regional capacities for quality teaching programmes, undertake applied research and promote information sharing in AM. In particular, the long-term objective of the UCAM at BIUST include:

- a) Effective postgraduate teaching and research at BIUST;
- b) Regional knowledge transfer from BIUST to ELbM

partners, African institutions and industries;

c) Empowerment of Batswana researchers to solve engineering problems, especially in machine design/fabrication and products/service development;

d) Increased employability of Batswana engineering graduates;

e) Promote postdoctoral training to improve the research expertise of AMEE researchers;

f) Increase the capacity of Batswana students to study, research and employ AM specialised knowledge for undertaking projects for infrastructural development (drones, satellites, biomedical implants, radiation shields), including the possibility to experience new methods of studying and learning;

g) Increase the number of Batswana academic staff awarded with doctoral degrees in AM;

h) Increase the number of co-tutored programmes and projects to integrate PhD and Master programmes between ELbM universities;

i) Improve the capacity of academic and support staff to develop and design curricula that responds to labour market and societal needs, exploiting the opportunities offered to share best practices with partners;

j) Improve international visibility of BIUST through joint ELbM publications, conference presentations, etc.

**INAUGURAL PHD GRADUATE
OF DEPARTMENT OF ELECTRICAL,
COMPUTER AND TELECOMMUNICATIONS
ENGINEERING CELEBRATED**



Dr Dauda

A Viva Voce of the PhD thesis titled “Hybrid Energy Harvesting System Design and Optimization for Seismic Network.” by Dr Duncan Dauda was held on the 5th May 2022. The inaugural PhD candidate in the department of electrical, computer and telecommunications engineering discussed how remote seismic nodes frequently experience failure because of the short lifecycle of lead–acid batteries. Dr Dauda then developed an energy harvesting system with hybrid energy storage characterised by optimized constraints to enable the creation and maintenance of a sustained remote seismic node database.

The student adopted a single-diode model of the solar cell and photovoltaic module and used fundamental equations to develop programs in MATLAB, Simulink, and PSIM. The output observations of voltage, current, and power were measured, compared, and presented in several graphs and tables. It is envisioned that the results of the study would contribute to near real-time monitoring of the seismic activity of an area and subsequently to the prediction of earthquakes.

The novelty of this research is its delivery of two power solutions at the remote seismic node, namely, low

computational effort having a low-cost algorithm, and a hybrid of lead–acid battery and super capacitor with a synchronous buck converter. Mr Dauda’s work is good quality research that generated new knowledge that has been published in five (5) reputable high-impact journals and presented at international conferences.

Ladies and gentlemen, we present to you Dr Dauda and wish him well in his future endeavors.



OUT GOING SRC FAREWELL DINNER

Outgoing cabinet posing for a group photo with BIUST Management

The Vice Chancellor's Office recently held a farewell dinner for the outgoing Student Representative Council Cabinet. The purpose of the event was to acknowledge them for the dedication and resilience they showed during their tenure as students' advocates.

Speaking during the event, the Deputy Vice-Chancellor Research and Innovation Prof Abraham A. Ogwu commended the outgoing 2021/22 SRC cabinet for the sterling job and leadership skills they portrayed during their tenure. Prof Ogwu emphasised that this assignment of leading other students should not be taken lightly as it paves way for them to be future leaders in the industry.

He said the University recognises the special contribution that the cabinet made to the institution as there was minimum students' displeasure because of the cabinet's professional advocacy for students' needs and advice to the management on many issues.

Prof Ogwu wished the outgoing cabinet the best in their future endeavours and reminded them that BIUST will always be their second home. He urged them to work hand in hand with the new SRC for the

betterment of the University.

When giving a vote of thanks, the Outgoing SRC President Mr Kago Mothupi appreciated his cabinet for the resilience they portrayed during their tenure. He said the dedication and unity made them achieve their mandate and promises to the student body.

He said the biggest highlight in their tenure was the introduction of the Ministry of Research in the Cabinet. "The introduction of the Ministry of Research was imperative as a STEM University as it will facilitate the core business of the University," Mothupi said.

The outgoing president urged the Office of the Dean of Student Affairs to always welcome the new cabinet and guide them so that they realise their mandate of existence.

PALAPYE TECHNICAL COLLEGE

HEAD GRACE BIUST CAMPUS

By: Tshegofatso Teseletso

The new Palapye Technical College (PATECO) Principal, Mr. Montlamedi Elijah accompanied by his deputy Mr. Oteng Tshimo recently paid a courtesy visit to the Botswana International University of Science and Technology (BIUST) campus.

The sole intent of this visitation was to introduce Mr. Elijah to the BIUST Vice Chancellor, Professor Otlogetswe Totolo. It was also for the two parties to explore the possibilities of forming a united front based on their mutual vision of seeing to the realisation of a knowledge-based economy in Botswana.

“Here at BIUST we believe in social relevance hence we strive to bring solutions to diverse societal problems by intentionally creating a practical and entrepreneurial learning environment for our students,” Prof Totolo said when welcoming the PATECO delegation.

The vice-chancellor stipulated that as an institution of industries BIUST acknowledges the relevance of working with other companies and organisations as the phrase notes that ‘no man is an island’. He indicated that the colleges that are grounded in skills development such as Palapye Technical College played a pivotal role in the knowledge-based economy transformation and were the right partners for BIUST.

The Vice Chancellor concluded by expressing his desire to collaborate with Palapye Technical College for mutual beneficiation and improvement of Botswana.

In response, Mr. Elijah appreciated BIUST for the warm welcome. He highlighted that Palapye Technical College was inspired and encouraged by hands-on institutions such as BIUST, a university that continues to instigate impactful projects, notably, the drones for health initiative. “We are looking forward to learning and possibly uniting with BIUST for the advancement of our country,” he said.

Mr. Elijah further indicated that skill mismatch was



From left to right: Mr Elijah (Palapye Technical Principal), Prof Totolo (BIUST VC) and Mr Tshimo (Deputy Principal Palapye Technical) during the courtesy visit

quite prevalent in Botswana. “There is a discrepancy between the skills that are sought by employers and the skills that are possessed by our graduates,” he said, noting that the world was forever evolving digitally and that there was a need to keep up to date with all the developments.

Mr. Elijah applauded BIUST for the great things that they were doing in Palapye and across the globe.

For his part, the BIUST Deputy Vice Chancellor-Research Development & Innovation Prof. Abraham Atta Ogwu stated that the PATECO visit was paramount in that it would open doors between the two institutions as he believed it was the right step towards a fruitful alignment. The thrilled Prof. Ogwu implored the new Principal to utilise the accessibility of the university by uniting with BIUST and ensuring that their learners are trained with diverse latest machinery and world recognised skills-set found within the institution.

BIUST EQUIPS ENTREPRENEURS WITH TECHNICAL EXPERTISE

By: Gofaone Motswagole

Botswana Internationally University of Science and Technology (BIUST) is an environment that is professionally equipped for 21st-century learning, where government, industry and academia collaborate to focus and empower the next generation of creative thinkers through creativity and innovation.

Recently, the University through the Centre for Business Management, Entrepreneurship and General Education (CBMEGE), virtually hosted a three-day 2nd Innovation & Entrepreneurship Boot camp. Over 30 participants graced the event. The three-day virtual boot camp hosted panelists who deliberated on several topics that were tailor-made to equip attendees with soft skills that will give entrepreneurs a competitive edge in the business world.

The boot camp was held under the theme, 'Service Sector Sustainability: Navigating Contemporary Challenges'.

Within the list of the objectives, the main aim was to offer entrepreneurs industry secrets such as lessons on how to do business in China, given that China has a thriving and lucrative market. The University saw it fit to provide the participants with knowledge of some cultural aspects of China and information that would help them do business with ease.

In addition, the focus was also on instilling practical knowledge of innovative services marketing, effective communication skills, the ability to apply relevant business ethics in service provision, and knowledge of embracing new opportunities arising from contemporary challenges.

When delivering the opening remarks, the Director of the Centre for Business Management, Entrepreneurship & General Education, Professor Patricia Makepe, highlighted that BIUST has a mandate of producing scientists and engineers who do not only know the core technical skills of their profession but who have soft skills that can help them achieve their goals in the business world.

Professor Makepe stated the boot camp aimed to empower entrepreneurs in the Service Sector with practical knowledge and relevant skills in sustaining their businesses to achieve sustainability in the face of the current macro-economic environment created by

the COVID-19 pandemic.

"This time around we chose to focus on the challenges faced by the service sector because this sector was severely hit by COVID-19. While the severity of the pandemic has reduced, it has not completely gone, and challenges remain which still need to be addressed," emphasized Prof. Makepe.

Furthermore, Professor Makepe said the training offered a platform for discussing critical issues and seeks to equip service providers with skills in enhancing the productivity and efficiency of their sector in Botswana. She continued to explain that participants would have the opportunity to reflect on their businesses and identify loopholes that need to be addressed through practical application of the acquired knowledge and skills.

Mr Kelebonye Bagai of the Department of Academic Literacy and Social Sciences stated that entrepreneurs faced a lot of challenges in conducting businesses during the pandemic, as they could not meet their clients physically and build business relationships. Mr Bagai noted that communication is an integral part of business, and it was disrupted during the pandemic era.

He also mentioned that it was important for people to communicate effectively because one's customer base is built on communication. He cited that culture, communication and ideology go together.

Boot camp attendees were also served knowledge on various topics such as Client Relations, Quality Service Provision in the Service Sector, and Pocket Guide to Doing Business in China, Bootstrap Marketing Techniques and Intellectual Property in the Service Sector.

In hosting this boot camp, the Centre has collaborated with both private and public stakeholders for the transfer of knowledge and skills to entrepreneurs in the Service Sector. The facilitators of the training included Centre staff experts, Botswana Bureau of Standards (BOBS) who were invited to share the service standards, Local Enterprise Authority (LEA) and CEDA also presented on the various types of support offered to small businesses.

Overall, the Innovation and Entrepreneurship Boot camp has brought together various entrepreneurs in different areas of business who all desire to grow and sustain their businesses. Through this boot camp, BIUST has shown its unwavering commitment and support to improving the economic landscape of the nation by imparting knowledge and skills to Small and Medium Entrepreneurs in Botswana.



THE GERMAN, BIUST CAMPUS EXPEDITION BENEFICIAL TO ACADEMIC

ADVANCEMENT

Prof Totolo receives books from the German delegate

By: Tshegofatso Teseletso

On the 27th of April 2022, a German delegation comprising experts from diverse industries graced the BIUST campus. The intent of the visitation was to appreciate the institution's learning environment sphere and present possible services that their various companies & organisations can bring to BIUST.

The exciting expedition commenced with an adventurous campus exploration. The university treated the honourable guests to an appreciation of the diverse types of equipment found within the Mechanical Engineering Laboratory, Electrical Engineering Laboratory and Physics Laboratory.

In his welcome remarks, the BIUST vice-chancellor Professor Otlogetswe Totolo expressed a warm welcome to the delegates. He described the courtesy visit as auspicious and a positive step towards the realisation of BIUST's mission to produce world-class graduates in research and innovation in science, engineering, and technology. He said the mission could only come to life by learning from the best players of the globe.

"We are quite humbled by your visit today," the vice-chancellor said before briefly defining BIUST to the guests through a university overview.

The Impactful expedition was cemented by an eye-opening presentation by German delegates at the university's Earth and Environmental Sciences Seminar Room. The delegates deliberated on their unique company services ranging from teaching aid programs, Infrastructure consultancy and equipment. The delegates wrapped up by appreciating the institution. In one accord, the delegation indicated that they were looking forward to collaborating with BIUST in the future.



BIUST & German delegates posing for a photo

BIUST MENTORSHIP PROGRAMME IN COLLABORATION WITH USA'S NORTH CAROLINA STATE UNIVERSITY DEVEL- OPS ON-LINE APPLICATION FOR STEM MENTORSHIP AT SWANENG HILL SCHOOL.

By: Tshegofatso Teseletso

Botswana continues to struggle in its effort to create a strong pipeline of STEM professionals' population. The need is even felt more when assessing the participation of women in STEM-related careers. To attain its new envisioned economy, Botswana must address issues of gender disparity in STEM fields. One way to deal with this gap is to run girls' mentorship programs. This is where professional women (in some cases men) in the STEM space can have a hand in priming future female STEM, by so doing increasing the number of women in STEM professions and careers.

To deal with these concerns, North Carolina State University's Department of STEM Education formed a partnership with Botswana for purposes of attending to the stated issues. This is being done through a collaborative research project between Botswana and North Carolina State University 's Department of STEM Education and is a part of the U.S. Department of Defense's State Partnership Program. The North Carolina State University's Department of STEM Education was part of the delegation that came to Botswana in 2019 from July 13 to 20th and the visit, among other things, resulted in forming a growing research collaboration meant to inform the submission of a grant proposal to the National Science Foundation's ADVANCE solicitation.

The ADVANCE mission aims to have a more diverse and equitable human resource in the engineering field. ADVANCE mission is the funding arm of the National Science Foundation and contributes to NSF goal of a more diverse and capable science and engineering workforce, giving special attention to issues of gender, racial and ethnic equity.

The North Carolina State University's STEM Education Department becomes relevant with its online mentorship project. The project aims to address issues of equity and access through the development mentoring network that is facilitated through an education technology namely 'STEM squad' software which is meant to encourage female participation in STEM for Botswana.

The North Carolina State College of Education is working on a STEM Ed initiative entitled "Building Botswana's Capacity to transform from a Resource-Based to a Knowledge Economy, under the

leadership of Dr Cameron Denson, Associate Professor of STEM Ed. The initiative recognizes that in order for Botswana to succeed in this endeavor, Botswana must improve its approach to teaching and learning Science and increase the number of women participants in STEM careers and professions.

This project, which is in the form of research will put together formative and summative data on the influence of eSTEM mentoring model and the effectiveness of its accompanying software – STEM squad on female students' efficacy, interests and perceptions of STEM professions and careers.

As stated, the lecturer who oversees this project is Cameron Denson PhD, who is an Associate Professor, STEM Ed at North Carolina State University. Dr Denson has experience in mentoring, STEM identity and helping the underrepresented student population to perform well. So, Dr Denson envisages providing environments that are conducive to attracting females into STEM, to be a way to help Botswana realize its vision of transiting from a resource-based economy to a knowledge-based one. He wants to work with Botswana's (through BIUST) on a STEM mentorship program implementing elements of his mentoring model and also piloting his e-mentoring software application. Aaron C. Clark, PhD, Head of Department STEM Education N. C. State University.

As part of this project, BIUST through PUAP called for expression of interest by prospective mentors from BIUST graduate school, in which a total of fifteen (15) post-graduate students showed interest in participating. The project requires ten (10) mentors, so from the 15, Dr Denson, Associate Professor STEM Ed, and the leader of the research project will choose 10. The learners who are to be mentored are from Swaneng Hill School. Swaneng Secondary School was chosen on the bases of proximity to Palapye for purposes of monitoring and evaluation. Furthermore, and most importantly, Swaneng has actively participated in the e-lessons that are offered by BIUST, thus demonstrating its willingness to improve its STEM performance. A part of what contributes to low performance is the underachievement of girls in STEM subjects. The school has selected ten (10) girls, to be mentored one-on-one. The research project is aimed to start in April 2022 and lasts for sixteen (16) weeks.

Following the successful launch of the mentorship program, the other responsibilities for BIUST will be assisting with post-survey data collection at the time when Dr. Cameron Demson will be in Botswana. This may include a designated area where interviews will be conducted.