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The “Big 4 agenda remains a popular topic of discussion in Kenya’s political rallies as well as a popular heading in Kenya’s local newspapers. In order to achieve the flagship vision 2030, the sitting government has come up with accelerated 5-year development plan designed to fast-track the realization of the vision.

Although many readers are usually interested by problem solutions in Europe and America, this student magazine’s aim is to localize the problems we face as a country (Kenya), and deliberate on their solutions using the available resources and skills while intertwining the 5 thematic areas covered in Environmental Biosystems Engineering.

Diverse authors have contributed to this magazine both nationally and internationally. They are engineering students from TUM, JKUAT, Egerton, Kyambongo University (Uganda) and our very own UoN.

I would like to extend my sincere gratitude to the editorial team for their commitment in the publication of this first edition. Special thanks to EBESA executive for their immense support. We are also grateful to the Department of Environmental and Biosystems Engineering (UoN) for their continued support this far. And to all our sponsors, we are grateful. Thank you for partnering with us.

Special thanks The Nairobi City County Government for their overwhelming support in this issue. Thank you for partnering with us in magazine and we look forward to working with you in upcoming magazine issues and EBESA activities.

JOHN MUTUKU
Editor-in-Chief
The current issues facing communities need technical solutions that can only be solved through an engineering perspective. The Engineering courses in the School of Engineering have the best curriculum that can provide that edge to help the students to tackle this problems in society. This will help achieve Kenya’s Big four Agenda thus impacting lives and thus mentoring problem solvers. The department of Environmental and Biosystems Engineering is a multifaceted department that produces fully baked graduates who are highly employable in different sectors.

The employment cuts across the five thematic areas being offered at the department. Graduates can be employed in the Government, private sector, international agencies like the UN, processing industries, consultancy firms and parastatals. Enjoy reading the 1st edition of the Environmental and Biosystems Engineering Students’ magazine and learn the different problem solving approaches.

The global challenges that are characterized by: climatic change, shrinking biodiversity, increasing rural and urban wastes, air and water pollution and accelerated consumption of non-renewable resources require complex but sustainable solutions that are technically feasible, economically viable, environmentally responsible and socially acceptable. These challenges require approaches that will integrate multiple sources and numerous impacts to impart on land, water and air resources an interaction that produces food and supports life on the planet in a sustainable manner.

As Kenya and the region tackles the challenges of food security, gender empowerment, environmental protection, industrial development and globalization, the traditional role of engineers that involves single pass approaches to solve problems using resources that produce waste is changing to that of “Environmental and Biosystems Engineering” approach that employs the basic science of biology, mathematics, physics and chemistry as well as engineering sciences and designs to enhance the wellbeing of humans, animals, plants and the biosphere.

Our department is a key enabler of Kenya’s industrialization process and it uses resources sustainably such that there is no waste but the byproduct is recycled back as a raw material for another process making it a closed loop system. Have a great read of the 1st Edition of Environmental and Biosystems Engineering Students’ Magazine and discover the solution-based learning.
Welcome all to the 1st edition of The Biosystems Engineer. Environmental and Biosystems Students Association (EBESA) is a students' body in the department of Environmental and Biosystems Engineering.

The body was formed to air the voice of the Biosystems Engineering students and as EBESA, our main effort is to help the Biosystems Engineering Students achieve their goals in securing jobs in future, finding attachments and internships. We achieve all these through organizing career talks which are graced with the leaders from the industries that employ and mentor us, academic trips in Mombasa and also industrial visits within Nairobi where we visit industries that employ us.

Our endeavor is to ensure we bring the Engineering Corporate World closer to the students. Our planned calendar of events over the years has always been graced with activities and events that provide a more social and less formal environment to nurture the relationship among and between students and also to encourage networking of the students with the leaders in the engineering industries. The activities include open day which is held annually and where several events like elections and sport activities take place, clean ups, community outreaches etc.

The Editorial Board of EBESA, strives to market our course and to also keep you informed of who a Biosystems Engineer is and what role he/she plays towards making the world a better place. In this edition, we shall focus on how a Biosystems Engineer is working towards actualizing the Big Four Agenda of the Government.

I wish to commend Maxwell Onzere Ambani (EBESA Secretary General), John Mutuku (EBESA Editor-in-Chief), Euphemia King’erechi (EBESA Managing Editor), Kimaiyo Oscar (5th Year Editor), all the EBESA executives and the Editorial Board for their endless efforts in delivering service to the Biosystems Engineering Students and the School of Engineering at large.

Sincere gratitude to the Dean School of Engineering: Eng. Prof. A. N. Gitau, the EBE departmental Chairman: Dr D.O. Mbuge, the EBE Associate Professor: Prof. Biama and Dr Orodi EBE lecturer: Mr. Kimani, for their counsel and support towards making this magazine a success.

Special gratitude to the Principal College of Architecture and Engineering, Prof. Peter Ngau, we greatly appreciate your support in making EBESA activities a success.

A big thank you to Nairobi City County Government for partnering with us.

Finally, I extend my deepest thank you to the readers. We look forward to engaging with you more often especially through our events planned for the year, aimed at building Kenya’s economy through the Big Four Agenda. Have fun reading the issues and enjoy your read!

MAUREEN MULUNGO
EBESA Chairlady
CONTRIBUTING EDITORS

Euphemia King’erechi, MANAGING EDITOR
The Ebesa magazine is a platform for creativity and an avenue to nurture innovativeness. One can actually crack their mind around a problem and bring about a solution. It is an avenue to voice out our opinion as engineers and keep the conversation going. This 1st edition magazine journey has been one interesting and challenging roller coaster. I thank God for the far we have come, indeed without Him we are nothing. The future is Luminous!!!

Oscar Kimayo, 5TH YEAR EDITOR
A finalist, who is passionate in dealing with the real-world problems. He holds a strong believe that if Kenya’s full potential is tapped, the country can achieve holistic development within set timelines.

Agnes .A. Jagongo 4TH YEAR EDITOR
4th year Biosystems engineering student. Has great interest in food security and poverty reduction. Loves listening to podcasts, blogging, music and travel.

Alphonce Mbogo, 4TH YEAR EDITOR
A 4th year Biosystems Engineering student at the UoN. His natural curiosity, wacky sense of humour and optimistic nature are what set him apart. His goal is to change the world using his Engineering knowledge and skills.
WHAT IS UoN’S ENVIRONMENTAL AND BIOSYSTEMS ENGINEERING (EBE) ALL ABOUT?

WHAT IS ENVIRONMENTAL AND BIOSYSTEMS ENGINEERING (EBE)?

The origin of Environmental and Biosystems Engineering at the University of Nairobi can be traced back to 1965 when the Department of Mechanical Engineering, Faculty of Engineering introduced a section in Agricultural Engineering focusing on Agricultural Process Engineering. The Department of Agricultural Engineering of University of Nairobi was established in 1975 originally as the Department of Agricultural Mechanization and Farm planning. The name was then changed in 1976 to Department of Agricultural Engineering.

In 2003, the University of Nairobi senate ratified the change of name of the Department and the degree program to Environmental and Biosystems engineering to reflect the content and intent of the Department’s academic, research and consultancy services and to keep in tune with the expanding global challenges and demands. Changing the name and curriculum was through a consultative forum headed by Eng. Dr. Gichuki Muchiri. Consequently, the alteration of the name brought about drastic changes such as a significant increase in the number of students enrolling to the program.

The Environmental and Biosystems Engineering curriculum is all encompassing. Students gain skills in civil, electrical, surveying, agricultural, structurers, farm power and machinery, renewable energy, solar and water engineering. As a University Department, the objectives of teaching, research, development and advancement of scientific knowledge in the application of engineering, is captured through a dynamic curricular offered through undergraduate and post graduate programs. So far more than 600 graduates and 100 masters' students and 5 PhD students have graduated from the department.

OVERVIEW

Environmental and Biosystems Engineering is an integrated engineering discipline whose curriculum focuses on five thematic areas. These areas are Environmental engineering, Irrigation and Water Resources engineering, Power and Machinery engineering, Process and Food engineering, and Structures engineering. Moreover, there are many other additional units including: - Electronics, Geotechnical engineering, Infrastructure engineering, Instrumentation among others.
All in all, the integrated approach taken when coming up with this course eventually enables the students to be all rounded enough to enable them to enter the job market fully ready to provide innovative and sustainable solutions so much sought after.

For more information about the course, kindly scan the QR Code or visit http://ebe.uonbi.ac.ke/
The Nairobi City County Government under the able leadership of H.E Governor Mike Mbuvi Sonko has made exemplary strides in implementing President Uhuru Kenyatta's Big Four agenda which directly contributes to the realization of the Kenya's Vision 2030.

1. MANUFACTURING
The Nairobi City County Government has highly invested in manufacturing facilities. Transformation of the manufacturing sector has spurred employment in the county, notably the Kariokor Common Leather factory. The facility which is being constructed in collaboration with the Kenya Leather Development Council, aims to take manufacturing and industrialization to the next level. Other counties are expected to benchmark in this facility which is meant to utilize the leather produced from 11 slaughter houses and tanneries across Nairobi. Producing more than 80% of the shoes produced Countrywide (2 million pairs), Kariokor Market has created numerous job opportunities to the youth. In addition, this common manufacturing facility under construction which will be operational in June 2019. Fitted with modern machinery and equipment, the facility will ensure production of shoes which meet international standards as well boost Kariokor shoes market penetration into the global market. The facility is expected to enable production to rise from 2 million to 10 million pairs of shoes thus increasing trader’s income to 1 billion shillings annually by 2022. Job opportunities will created both directly and indirectly. The Kariokor Common Leather Manufacturing Facility is just an example of the manufacturing-based development endeavours of the Nairobi City County Government. In addition, Governor Sonko's government has set aside funds to improve SMEs.

2. UNIVERSAL HEALTHCARE
Governor Sonko's Government has made healthcare provision a top priority. Quite a number of health facilities within the county are beneficiaries in terms of equipment, service provision, partnerships, rehabilitation services, among others courtesy of Nairobi City County Government. Installation of Oxygen plant at Mama Lucy hospital, construction of six (6) new maternity wings one being a 120 bed capacity at Mbagathi hospital, expansion of bed capacity at Pumwani Maternity Hospital from 40 - 50 deliveries to 80-100 deliveries capacity per day, renovation of five (5) maternity wings in partnership with UNICEF, Sh 118m worth, 153 cold chain Fridges and 8 Power backup generators to enhance vaccination, decongesting KNH, renovation of 35 healthcare facilities, increasing healthcare staffing workforce, increase in number of community units have improved from 122 in 2013 to 220 in 2018, launch of its first Renal Unit at Mbagathi Hospital in 2018, establishment of Ngara Methadone NAIROBI CITY COUNTY Clinic that has enrolled over 400 heroin addicts who are undergoing rehabilitation, procurement of 5 state-of-art ambulances to improve referral services and reduction of maternal deaths and other medical emergencies, just to name a few, are the efforts which have been made by the county government to ensure universal healthcare.

The launch of the first Human Milk Bank in East Africa by Governor Sonko at Pumwani Maternity Hospital in March 2019 was a major achievement. The facility will greatly improve efforts by the Nairobi City County Government to end cases of maternal deaths at Pumwani Maternity Hospital. The facility which has a capacity of 150 baby cots, with a daily occupancy of 60 infants will be among over 600 human milk banks globally. Out of the average 60 infants per day, 10 to 12 infants are in need of donor human milk because they were born prematurely, have low birth weight, have medical conditions, or have no access to their mother's milk because of illness or death of their mothers at childbirth.
3. AFFORDABLE HOUSING

President Kenyatta’s Big 4 agenda aims to deliver 500,000 affordable houses by 2022. Nairobi is an important player in achieving this target. This is because nearly half of all the new houses, or 200,000, will be constructed in the city. The Nairobi City County Government recently achieved a milestone when the Nairobi City County Assembly passed the Nairobi City County Sessional Paper Number 1 of 2018 on Urban Housing Renewal and Regeneration Policy.

The Nairobi City County intends to construct over 100,000 housing units in phase one and two of the redevelopment of Nairobi’s old estates. The estates targeted in phase one of the Affordable Housing Programme are Ngong Road, Suna Road, Pangani, Jevanjee/Barchelors, New Ngara and Old Ngara. Phase Two will follow soon and some of the estates identified include Bahati, Jericho, Gorofani, Bondeni, Shauri Moyo, Lumuba, Maringo, Uhuru and Ziwani estates. Other estates will also come thereafter.

Strategic partners have been identified and the ground breaking will soon be undertaken. This process will continue until all old estates in Nairobi are covered. The Urban Renewal and Regeneration Programme seeks to transform the City into modern, accessible, affordable and adequate houses to the residents while concurrently optimizing on the use of land through densification process. Implementation to be done at two major levels. This is a World Bank funded project under the Nairobi Metropolitan Services Improvement Project (NaMSIP). Over 100,000 housing units are expected to be delivered; the ultimate goal is to transform Eastlands area into a mini city.

4. FOOD AND SECURITY

Food Security, food safety and nutrition plans are top on Nairobi City County Government’s agenda. The city now produces 20% of the local food demand. The sector performs extension and regulatory services and agri-business promotion as well as food situation assessment. Through extension services, the sector empowers producers of crops, livestock and fisheries on new urban agricultural technologies that achieve greater production under the limited arable land space in the County. The sector also promotes tree growing as a way of ensuring sustainable agricultural land use and greening of the City to enhance environmental benefits associated with trees.

The county government has managed to reach over 15,000 farmers with extension messages and technologies annually. Thirty-two greenhouses have been installed for institutions and groups leading to increased income from vegetables from Sh. 100,000 to Sh 300,000 per greenhouse in a cropping season. Additionally, 14 fish tanks and 5 milk dispensers have been installed for different groups. Nairobi City County government has been able to provide subsidized fertilizers to farmers, ensured vaccination of 25,000 animals against diseases, ensured 100% surveillance of notable animal diseases, licensing of 23 slaughter houses among others to ensure food security of Nairobi City residents.

On top of having in place strategies that are in line with the President’s big 4 agenda, Governor Sonko’s government has invested highly in commerce, tourism, cooperatives, education, youth affairs, gender, culture, and social services, Transport, Roads & Public Works, Environment, Water, Energy, Natural Resources, Information, Communication and E-Government, Finance and Economic Planning to ensure Nairobi residents access quality services from the county government.

You’re are kindly requested to be a champion in making Nairobi the City of choice to invest, work and live in.
UNIVERSITY OF NAIROBI
DEPARTMENT OF ENVIRONMENTAL AND BIOSYSTEMS ENGINEERING

Mission
To be a centre of excellence in undergraduate and postgraduate education and training in Biosystems Engineering Vision: To contribute to the attainment of Millennium Development Goals and Vision 2030 through teaching, research, consultancy and outreach in Environmental and Biosystems

Engineering Core Values:
• Innovativeness and creativity in the Engineering profession.
• Collaboration, networking and partnership for scientific and technological change.
• Relevance, effectiveness, performance, efficiency, impact and sustainability of Engineering practice.

BSc. Programme
• Basic sciences (Physics, Chem, Maths, IT, Eng. Graphics)
• Engineering sciences (Thermodynamics, Material science, Mechanics of Machines)
• Majors in any of the five thematic areas

Innovations
• Ecological sanitation
• Drip irrigation kit
• Digital mapping of rainwater harvesting
• Sisal Decorticator
• Groundnut Sheller
• E-learning course materials
• Constructed Wetlands

Industrial Attachments to:
• ICRAF
• Mabati Rolling Mills
• Davis and Shirtliff
• Unga
• Bidco
• Unilever
• Bamburi Cement
• Agrochemicals and Food Company
• Sugar and tea Companies
• Mastermind
• World Vision
• CMC among others.

International Linkages and Collaborations:
• University of Siegen – Germany
• EurA Innovation GmbH
• Department of Agri-Food Science and Technology - University Of Bologna
• Food and soft laboratory, ETH Zurich, DEUTSCHLAND
• Biofuel Africa
• World Agro forestry Centre

Career opportunities:
• Government Institutions
• Parastatals
• Private
• International
• Academic Institutions

Academic Programme
Five thematic areas:
• Environmental Engineering
• Irrigation and Water resources Engineering
• Power and Machinery Engineering
• Process and Food Engineering
• Structures Engineering

Extra curricular activities Student Clubs
• Engineering Students Association (ESA)
• Environmental and Biosystems Engineering Students Association (EBESA)
• Professional Clubs
• Kenya Society of Environmental, Biological and Agricultural Engineers (KeSEBAE)
• Institution of Engineers of Kenya
• Engineers Board of Kenya (EBK)

Research Activities
The department has had an active research programme in the areas of:
• Soil and Water Engineering
• Water Resources Engineering
• Agricultural Process /Food Engineering
• Granular mechanics
• Land Husbandry and Landscape Engineering
• Soil Tillage and Fertility Management
• Occupational Health and Safety
• Agricultural /Aquatic Machinery
• Concrete and Fibre Reinforced Concrete
• Timber and, Animal Housing
• Environmental Control and Simulation
• Rural Power, Transport and Access
• Produce Drying
• Water Systems Engineering
• Egg Incubation
• GIS and GPS Mapping
• Waste water management
• Environmental Impact Assessment and Environmental Audit

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DRIP IRRIGATION

Farming has a lot of challenges especially here in Kenya. Different parts of the country experience low rainfall and this possess a great risk on growth of crops for subsistence use. Different technological advancements in irrigation have since been applied to curb this problem. With water supplies likely becoming stretched could drip irrigation be the solution to our agricultural needs?

Drip irrigation (sometimes known as trickle irrigation) can has been used since ancient times and traces its origin back in China hence it's not as new as it may sound. It started out as using unglazed clay pots filled with water (ollas); to clay pipes then later on to perforated pipe systems and plastic emitters.

NOTE: Modern drip irrigation however is attributed to Simcha Blass who was an Israeli engineer and inventor in the 1930's.

HOW DOES IT WORK

The process can simply be described as water applied directly and slowly to the soil. Water is delivered across a field using 'driplines' featuring smaller units known as drippers which emit drops containing water and fertilizers in a slow and steady fashion. It is quite simple in design and highly efficient since water is applied where it is needed most i.e. the plant roots.

BENEFITS

A few of the benefits this method brings are:-

• Energy saving: drip irrigation works on low pressure
• Less dependency on weather
• Huge water savings: no evaporation, no run off
• Efficient use of fertilizer and crop protection
• Low cost

The beauty of this method of irrigation is that it doesn't require large tracts of land. It conserves a lot of water in the process. Moreover, since it only waters the plants, it helps keep the weeds down.

However, clogging up or blocked emitters could be a challenge using this method of irrigation.

Kenya as a country is divided into different climatic zones. This method of irrigation has been able to greatly benefit areas that experience low or unreliable rainfall. I believe that if we were able to apply this even in the areas that do have good rainfall we would be able to achieve two things.

That is, good yield and save on water. Water saved could be used to bring more land into irrigation now that water is slowly becoming scarce as the years go by.

In conclusion, as we strive towards goals in food security and nutrition, we can all agree that it all begins with the small farmers and many have actually tried and used this method and it increased their yields. You don't need a large 'shamba' for this to work it and if you do it still benefits you anyway. Let's tap into this
WHAT THE INDUSTRY SAYS ABOUT ENVIRONMENTAL AND BIOSYSTEMS ENGINEERING

In an interview with Mr Kipruto Cherogony, a practicing Environmental and biosystems engineer since 1989, we were able to learn the Environmental and biosystems engineering perspective of a practicing engineer.

About Engineer Cherogony?

I did an undergraduate degree in agricultural engineering and Msc. Soil and Water Engineering where I specialized in Rain water harvesting and management. I have done numerous water projects in Nairobi, Machakos, Baringo, Somalia, Tanzania, Rwanda, among others.

Most of these projects were meant to have technology in place that farmers could handle themselves. A high percentage of these projects used locally available materials. I have worked for many consultancy firms and organizations including Regional Land Management (RELMA), Kenya Rainwater Organization (KRWO), Horn Relief formerly known as ADESO (African Development Solutions), ICRAF (The World Agroforestry Centre). I am currently working for Eor Ekule Dairy Limited as a Technical Advisor.

How would you describe an Environmental and Biosystems Engineer?

The engineer who helps the society to deal with issues of water, soil, and materials to improve livelihood, weather, structures. Uses engineering aspects that deal with animals, grains, fertilizer, water, storage, and conveying to find cost-effective solutions.

Difference between civil engineering and Environmental and Environmental and Biosystems engineering?

There is a thin line between the two because while studying, there is intermingling and application of various disciplines such as soil mechanics and design of water systems. Civil engineering is more into structures while Biosystems engineers are more linked to rural, farming system (agriculture), food system; applies engineering knowledge to better the field.

Biggest challenge faced as an Environmental and Biosystems engineer?

Biosystems engineers are not given an equal opportunity to deal with a bigger role. Unavailability of resources is a major challenge.

Biggest achievement?

I have actively contributed in water harvesting interventions which has changed the face of the environment. Water for environment is the most crucial as its absence leads to the removal of vegetation cover, there is more run off, land turns dry and bare, and it is more problematic to get water for livestock and plants. I have applied engineering principles to the ground a storage sponge thus making water available for all uses.

What advise would you give to aspiring Environmental and Biosystems engineers?

This field is wide with lots of techniques and skills that are so much needed in the society. We need to drop the culture of being consumers. We need to produce the tools to transform our lives. We should use skills and knowledge to increase income. 80% percent of Kenya is ASAL; the department of Environmental and Biosystems Engineering University of Nairobi offers solutions to water problems experienced in these areas.

Interview by John Mutuku
(5th year, Biosystems Engineering)
In an interview with Eng Margaret Kuchio, the General Manager, Commercial at Davis & Shirtliff we were able to learn of how she broke the barriers and rose through the ranks and has created a path for female engineers. She is a woman of many firsts and has a diverse work experience of 22 years at Davis & Shirtliff. She is a mentor not only to the upcoming young female engineers but also to the young female professionals in the industry.

**About Engineer Margaret?**

I joined the University of Nairobi in 1990 and studied Agricultural Engineering (the current Env. & Biosystems Engineering). I graduated in 1996 and was among the top in my class. I joined Davis & Shirtliff in 1997 where I started working with the wholesale department. It was an interesting experience, I was teaching the hardware people about the products. I was breaking down the technical bits in an easier language. I later became the wholesale boss after two years.

During that period, around 2005, the company came up with the idea of opening branches in Nairobi and I became the first lady branch manager when I opened the Westlands branch in 2005. This branch became successful, it ended up bringing big returns to the company. The Westlands branch’s success led to the setting up of other branches in Nairobi. I had created a great customer portfolio and was commended to go back the head office. I was networking and convincing customers why they should be in Davis and Shirtliff.

I was later, in 2014, tasked with the assignment of setting up the Eastern Cluster branch network focusing on the Eastern and North Eastern Parts of Kenya. The first assignment was to open a branch in Garissa which was no mean task due to the state of insecurity then. This network of branches grew very fast and was highly successful. After 4 years running the Eastern Cluster, I was challenged to manage the Western Cluster covering Western, Nyanza and Rift Valley provinces. Currently I am in charge of 30 branches covering Eastern, Western and Nairobi Clusters.

**What is your biggest achievement as a female Engineer?**

Being the first female Branch Manager was the greatest foundation for my career. In addition, I got an award for good performance.

When I was recalled to Head Office after successfully running Westlands branch for about 3 years, I was tasked with the assignment of bringing back on board customers who had drifted away from Davis & Shirtliff. The biggest challenge was the East African Breweries Ltd who were previously big customers. I was able to beat this milestone, I broke the barriers and brought them on board and they have consistently been our top customers ever since.

Building and managing the Eastern Cluster branch network got me Manager-of-the-year Award twice in a span of 3 years which was a great achievement given I am the only woman who has achieved this in the organization.

**What are the challenges as a Female Engineer?**

Striking a perfect work-family balance and the perceptions in society that an Engineer should be a man.

**Apart from Engineering what do you love doing during your free time?**

I am a very present and participatory mother in the lives of my 2 teenage daughters. I create time for my kids. I spend time with the needy, it has always been my dream of setting a foundation to educate the less fortunate in the society. I am a Christian, I love spending time in church. I love socializing too.

**What is your word to the aspiring young lady Engineers?**

Understand yourself, know what you want, set standards and do not compromise. Be open-minded. Chart your own path. You are going to go through rough patches but do not give up. Do not get side tracked. Have confidence as woman and do not downplay it. Find your space at the table and do not allow to be overshadowed as a lady. Do not take the second row, take the front row. Above all, pray to God so that you can find a perfect balance.
This event was organized by the Engineering Students Association (ESA) of the University of Nairobi. It bridges the gap between engineering students and the industry. It hosts universities in the entire country and beyond East Africa. The IESC 2019 was graced by Infrastructure Secretary Eng. Gitau. The Project den was spearheaded by the Environmental and Biosystems Engineering students. This contributed greatly to the success of the conference. The project den’s main roles were: Mobilizing students from all the Universities in Kenya and beyond to apply for the project competition, preparing panel discussion questions for the conference and coordinating the presentation process.

PICTORIALS

THE INTERNATIONAL ENGINEERING STUDENTS CONFERENCE

1. Euphemia, Maureen and Lynn with IEK First Vice president Eng. Jane Mutulili
2. Gideon Njoroge in one of the panel discussions
3. Euphemia presenting a gift to the Infrastructure secretary Eng. Gitau (panelist)
4. Maureen, Maxwell and Euphemia - The project den announcing the project results
5. Euphemia King’erechi - Head of the project den - IESC 2019
6. Maureen Mulungo - Member of project den - IESC 2019
7. Maxwell Ambani - Member of the project den - IESC 2019
8. Glory Chebet pitching her project
9. Oscar Kimayo pitching his project
10. Collins Onyancha pitching his project
ACCREDITATION PARTY

The department of Environmental and Biosystems Engineering was formerly known as Agricultural Engineering. The Engineers Board of Kenya (EBK) accredited the program and listed it on their website after many years of struggle. On 2nd February 2018, the department held a celebration to mark this occasion.

CAREER TALK

An EBESA career talk held on March 6th 2019 with the theme as “Understanding Environmental and Biosystems Engineering and planning your career in order to take the next step. The guest Speaker was Prof. Gumbe from Log Associates.

DR. MUSIMBA AWARDS

Cake cutting by Dr. Mbuge from left, Prof. Gitau, Maureen, and Dr. Waweru

Biosystems Engineering students receiving Dr. Musimba awards for the female category

Biosystems Engineering students receiving awards for the male category

ENGINEERS WITHOUT BORDERS IN CONJUCTION WITH THE DEPARTMENT

Dr. Mbuge with Engineers without borders from University of Massachusetts Amherst college, USA

Lynette Kinya with Engineers Without Borders (Massachusetts University-USA) at a water project site in Nguluni, Makueni County
THE NAIROBI INNOVATION WEEK

This is a platform by The University of Nairobi that supports and accelerates the innovation and sustainable entrepreneurship ecosystem in Kenya and the African region. Our students took part in the NIW 2018 that was themed ‘Innovating for a better tomorrow!’ which was graced by the CS. Education Ambassador Amina Mohamed. The second edition was graced by His Excellency Uhuru Kenyatta.

AGRICULTURAL SOCIETY OF KENYA PLOUGHING COMPETITION

This is an annual event organized by the Kenya Ploughing Organization (KPO) which is a sub-committee of the Nairobi International Trade Fair (NITF). Our students participated in the disc ploughing competition.
ACADEMIC TRIPS

The Biosystems Engineering students give back to society. They spare time to participate in children’s home visits to put a smile on a child’s face.

CHILDREN’S HOME VISIT

The Fifth year Biosystems Engineering team during open day

FOOTBALL TOURNAMENT

Apart from topping academically, the Biosystems Engineering students engage in sports.

ENVIRONMENTAL MANAGEMENT

EBESA organized a clean up in conjunction with Environmental Sustainability

Tree planting at Isinya Primary School in Kajiado County
CEREAL KILLERS

Food security remains to be a crucial yet challenging goal in our country Kenya and there are different factors have been identified that seem to threaten this cause. More than a thousand species of birds are found in Kenya. What a blessing. However, it also poses as a great disadvantage when it comes to our fields.

Cereal crops are most vulnerable to attack by birds especially during the dry seasons when food for the birds from wild grasses is scarce. Rice and wheat are among the most consumed foods in the country and could potentially propel the country towards food security if produced in sufficient quantities. When birds eat the grains before harvesting, the amount of yield from cereal crops is lowered.

How then can we solve this problem?

Birds are deterred majorly by sound and reflective light. The best solution, therefore, to this problem would be to develop a simple structure that uses wind & solar energy to drive some plastic vanes which have Aluminum foil & pebbles in a closed cap attached to them. This is for light reflection and sound emission respectively. Wind would drive the light plastic vanes which would then trigger sound emission from the pebbles enclosed in cylindrical caps. (Solar energy can also be utilized by tapping it using miniature solar panels and converted into rotary motion of the vanes by use of mini motors.)

The plastic vanes are wrapped using a piece of Aluminium foil which produces a sharp reflection of light when exposed to sunlight. This solution is cost effective and most of the materials can be easily obtained locally and at cheap costs.

Major materials required are: an anchoring pole for the equipment about 2m of height, a miniature solar panel and mini-motor with connecting cables, plastic vanes which can be obtained by cutting used plastic containers, small cylindrical bottles with some pebbles and sand and a roll of Aluminium foil.

We can achieve food security in Kenya and one of the ways would be dealing with these cereal killers and as a result maximize our yield. If adopted, the above discussed technique can be a reliable method to keep off the birds from crops.
I have always had this long running fantasy of owning a large home and if you are a self- respecting millennial or post-millennial, you might have had this fantasy at some point in your life too. In this environmentally woke era, there’s a need to ensure that our houses are as sustainable as they are affordable.

1 First, we should consider smart homes a priority when building houses. Automating several aspects of your home is an investment as it ensures you have control over every aspect of your house regardless of your current location. Smart homes that have security systems installed enable owners to watch what happens inside their home when they may be away. For those with children, increased safety for children when left at home is another added advantage. In addition, smart homes, by monitoring and controlling, help reduce the amount of energy expended thus allowing us to save money while being mindful of the environment. The convenience is surreal. You no longer have to race against the darkness after you close your lights to go to bed and if that doesn’t convince you then I don’t know what will.

2 A recent trend has arisen in sustainable housing known as ‘Net-zero homes’. Essentially, this type of house produces as much energy as it consumes by combining the use of solar panel technology and is energy efficient. A Net-zero home is a lot more durable as compared to the regular homes in the market because of the high-performance windows and good insulation. You no longer have to worry about energy price increases and being connected to the main grid becomes an option. The real kicker is that you spend way less on energy not just for a period of time in the year but all year round. In addition, these kinds of houses come equipped with water saving technology.

3 While we may not be able to afford new state of the art homes having the latest technology at the moment, we can retrofit our current homes instead (which basically is the addition of new technology to older systems, such as installing a smart thermostat, using LED lighting, using eco-friendly cleaning products and using water in a manner that is considerate to the environment. Smart housing is at the forefront in sustainable housing developments and we should embrace the change brought about by this technology. As we strive to empower ourselves to do better, we should not just do it for ourselves but for the environment too.
CLIMATE CHANGE: IT IS TIME FOR ACTION!!!

By Kiswa Benson, Fifth year student (2019), Biosystems Engineering

The Special Report on Global Warming released by the Intergovernmental Panel on Climate Change (IPCC) shows that the world is on road to exceed the 1.5°C warming between the year 2030 and 2052. Back in Kenya, the Greenhouse Gas (GHG) emissions is less than 1% of the total global emissions; hitherto its economy that is heavily dependent on the climate sensitive segments such as agriculture, water, tourism, wildlife, energy and health.

From the Economic Survey report of 2018, it is projected that the cost of droughts will create a long-term monetary obligation corresponding to 3% of GDP each year. In the year 2018, the country experienced heavy floods which, were preceded by the 2014-2018 drought which was declared a national emergency in February 2017. Even with the risks posed, adaptation efforts are currently insufficient to avert losses associated with the 1.5°C warming; these efforts can be significantly increased to lessen the negative consequences of climate change.

Kenya has thus developed the Second National Climate Change Action Plan (NCCAP) 2018-2022, that provides a clear framework for Kenya to deliver on its Nationally Determined Contribution (NDC) under the Paris Agreement.

Manufacturing and affordable housing are key pillars of the Big Four Agenda; they heavily rely on the availability of raw materials that would guarantee production of products that are sustainable and affordable.

Agriculture is the major contributor to Kenya’s economy (31% of GDP) in terms of food and nutrition security, creation of employment, source of agro based industry raw materials and foreign exchange. This sector is however extremely vulnerable to the ever-changing climate trends largely due to increasing temperatures, changing rainfall patterns and extreme weather events.

With about 98% of Kenya’s agricultural activities being rainfed, Adoption of the Kenya’s Climate Smart Agriculture Strategy (KCSAS) 2017-2026 is timely as it outlines the strategies and measures necessary to enhance agricultural production. KCSAS is expected to transform the agricultural systems to sustainably by building a resilient agricultural system while minimizing emissions for an enhanced food and nutrition security and improved livelihoods.

Manufacturing and affordable housing are key pillars of the Big Four Agenda; they heavily rely on the availability of raw materials that would guarantee production of products that are sustainable and affordable. Timber being one of the main drivers of these pillars. Therefore, there is need to move from the linear economy of “take, make dispose of” model of production to the circular economy enhanced by resource use efficiency and the adoption of the 3R philosophy of reducing, reusing and recycling wastes. This circular economy is part of the Sustainable Development Goal (SDG) 12 on the responsible consumption and production.

Tropical deforestation contributes to almost 20% of the GHG emissions into the atmosphere, leading to global warming. More effort should be placed on the restoration of the mangrove forests as it is on the terrestrial forests. Restoring and protecting mangroves will play a big role in atmospheric carbon dioxide capture to mitigate effects of climate change, improve livelihood and conserve biodiversity.

LET’S WALK THE TALK.
The extent of the plastic problem in Kenya is not one any Nairobian should be ignorant about yet here we are. Producing an average of 500 tonnes a day, Nairobi continues to bury itself in a heap of garbage. It might not be visible on the street as one drives or walks about but one need only leave the CBD to experience the extent of this problem.

To the North, Ngara, though not nearly as bad as it once was, is hardly clean. The Nairobi River has been described to be a sewer yet we gladly accept its state. To the East, Wakulima market has a garbage dump adjacent to it. The streets, piled with heaps of decaying fruits and vegetables. To the North West, we have Kangemi. To the South East, we have Kariokor and Majengo. Need I say more? Evidence that Nairobi is in crisis is more than sufficient.

How do we solve this problem? There are several levels at which the problem seems to exist: the social, corporate and individual level.

As a society we need to change our attitude towards problems. How often do you hear the phrase, “Serikali saidia”. Without undermining these people’s problems, I seek to illustrate our underlying dependence on the government to solve our problems. If we don’t take action as a people, can we hope the government does the same? An ideal government, ready to solve the plastic pollution problem, would be hesitant to commit resources if the public isn’t willing to keep the country clean. We must desire clean environments and take action as a society.

At the corporate level, using biodegradable raw materials, cleaning polluted areas as part of CSR and having environmentally conscious work place rules ensures we have clean living areas, clean soil and water. Simple as it may seem, this is a large contributor towards a clean Kenya.

At the individual level, recycling and reusing plastic containers, proper disposal of plastic bags, bottles and electronics and teaching our children to be environmentally conscious is a good first step. Remember, the generation that destroys the environment isn’t the generation that pays the price. Let’s protect our children’s future as outlined in the guiding principle of sustainable development that is, intergenerational equity.

We all have a part to play. Public-private sector cooperation is important. Incentives, such as, decreasing payable tax by industries according to the state of their discharge with respect to established environmental standards would result in cleaner rivers availing more usable water. Creating conducive environments for plastic cycling industries provides employment and cleans the environment.

In conclusion, Prof. Wangari Maathai once said, “I’m very conscious of the fact that you can’t do it alone. It’s teamwork. When you do it alone you run the risk that when you are no longer there nobody else will do it”. It starts with you.
According to the data from the National Health Survey on Disability (NHIS-D), roughly 0.4% of the adult population in the world between the age of 18 and 65 use wheelchairs.

Over the years, very little considerations have been made during construction of buildings that cater for the unique needs of the disabled. As a result we have over 95% of most multi storied buildings lacking ramps and lifts.

Modification of these structures would be very expensive therefore not feasible. At the same time, demolition is untenable. This article explains a project that seeks to design a wheelchair which can be used on staircases.

How can we solve this?

A wheelchair that can manually climb staircases. The concept of this project falls under power and machinery systems engineering utilizing two mechanisms; a rack and pinion along with the decoupling mechanism of the wheelchair from the ground.

Movement of the rack and pinion
- Rod 1 is the transmission rod connecting gear wheel 1 and gear wheel 2.
- When the gear wheel moves along the rack (due to rotation of gear wheel 1), plate 1 follows a similar trajectory.
- As gear wheel 2 reaches the lower part of the rack then plate 1 comes in contact with the ground and as gearwheel 2 moves along the lower part of the rack, plate 2 is lifted up from its initial position and moved forward with respect to plate 1.

Decoupling the movement of the wheelchair
- The idea of this is to de-couple the motion of the chair while moving up the staircase into two.
- The inner slide is directly attached to the wheelchair. The cam can thus move the inner slide vertically up and down.
- The wheelchair that is directly attached to the inner slide can then be raised from the ground by this cam action.
The World Health Organization (WHO) states that Food Security is achieved “when all people, at all times have physical and economic access to adequate/sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life”.

Some of the causes of food insecurity in Kenya include, insufficient production, unpredictable weather and climate change and lack of adequate storage facilities.

In an effort to help solve the food insecurity in Kenya, an integrated solar powered irrigation system, an air-conditioned greenhouse and a solar powered cold room system has been proposed. The system is aimed at improving production and preservation techniques.

Using a solar pump to pump water from underground to irrigate the crops being grown in an air-conditioned greenhouse improves on productivity. Crops can be grown continuously and under controlled conditions.

Solar powered cold rooms will also be designed to improve on the preservation of the grown fruits and vegetable. For cereal crops such as maize grains, the corn could be stored in silos.

We can thus conclude that food security is directly proportional to food preservation techniques applied. The project aims at attaining this by utilizing the abundant solar energy resource.
All hope is not lost. It is up to us to save the present and the forthcoming generation. Our future as Kenyans depends on us.

Agriculture is the backbone of my motherland, Kenya. It is the engine that drives our economy and a robust tool for promoting national development. Surprisingly, citizens are dying of hunger. Why is there food scarcity yet my beloved sand Kenya, receives rainfall throughout the year? There is enough food for everyone but not everyone has enough food. People are wailing day in day out due to hunger. Why should there be relief food yet we are one of the most productive countries in Africa? The energetic work force is decreasing yet there is an increase in population growth. According to statistics, four children die of hunger in every minute of the day. This is a wakeup call to us all!

The global temperatures are rising and the beautiful ice caps on the mountain tops are melting while the sea levels are rising. Green-house gas emission is no news to us. The climate is changing and it is threatening food security and could potentially lead to famine. A huge fate lies before us.

Why don’t we go back to the days of old when we used to be a low carbon economy? To the days that organic agriculture and ecological farming were embraced. Why don’t we consider implementing simple initiatives such as the cut one tree plant two initiative in every household? At the end of the day it begins with you and me.

This will go a long way in not only saving generations to come but healing our land. Other methods include initiating proper rain water harvesting techniques, development of irrigation schemes and dedication of more land to agriculture instead of residential and industrial development. Let’s fight for food security.

It is one thing to have a great harvest and another to put the same on the table. We need to invest in proper drying mechanisms that will accelerate the drying process and improve on storage, hence, curbing of post-harvest losses.

All hope is not lost. It is up to us to save the present and the forthcoming generation. Our future as Kenyans depends on us.
There is a continuous rise in population growth. To meet the needs of this rising population, more resources are involved. This trend has led to high consumption coupled with high waste generation. The irony of the matter is that while the world population continues to grow along with resource consumption and waste generation, the resources are becoming limited, triggering various responses. There is a need for efforts from all sectors in solving this paradox, more so to ensure reduced resource use, consumption and waste generation.

Urban solid waste management is one of the most immediate environmental problems confronting urban governments. This challenge will increase in the future given the trends of rapid urbanization. Due to growing public pressure and environmental concerns, engineers worldwide are being called upon to develop more sustainable methods of dealing with municipal waste that embrace the concept of a circular economy.

Recycling organic waste material (biowaste) is still limited, especially in low and middle-income settings, although this is by far the largest fraction of all generated municipal waste. This project deals with rural and urban organic waste from households, commercial activities, and institutions.

It describes the fairly novel approach of biowaste conversion by insect larvae, using the example of the Black Soldier Fly (BSF), Hermetia illucens, its popularity links to the promising opportunities of using the harvested BSF larvae as a source of protein for animal feed, thus, providing a valuable alternative to conventional feed.

In this project, however, we follow a waste management perspective. Biowaste is the substance of concern, the BSF treatment technology is used as a suitable processing and recycling solution to produce larvae and waste residue.

The residue (final product after BSF has consumed all the nutrients from waste in a period of 10-14 days), a substance similar to compost, contains nutrients and organic matter and, when used in agriculture, helps to reduce soil depletion.

There is a high waste-to-biomass conversion rate of up to 60% on dry weight basis, which is a satisfactory output quantity from a business perspective. (rate of waste reduction)

There is no need for sophisticated high-end technology to operate such a facility. Therefore, it is suitable for low-income settings that rely mostly on simple technology and unskilled labour.

The primary goal, therefore, is to process biowaste in an efficient way with regard to investment and operational costs, as well as space requirements. By processing biowaste, threats to public health and the environment can be reduced.

The technology solution consists of feeding segregated biowaste to BSF larvae, which have been reared in a nursery. Larvae grow on the waste feedstock and reduce the waste mass. At the end of the process, larvae are harvested and, if necessary, post-processed into a suitable animal feed product which in turn helps in boosting food security.

The waste residue can also be further processed and potentially sold or used as soil amendment with fertilizing properties. (Production of pure organic manure hence high yields on our farms, food security). The larvae are non-poisonous wastes and can thus be dried and fed thereby contributing to food security. These wastes when managed effectively reduces the risk of water-borne and air-borne diseases.
The new look of a Biosystems engineer in the modern world design.

How many times have you thought of becoming a Biosystems engineer? If you like design then this is the course to pursue.

Biosystems engineer, a special type of engineer who not only design structures, industrial machinery, irrigation systems and roads but also design the most sophisticated machines, the robot.

Why Robots?

The processing and production world of engineering has numerous challenges that need to be addressed, not limited to wastage, health hazard and incomplete processing. Have you ever thought of how assembling of an engine would be tiresome without robots? Wondered how the hazardous production of chemicals are monitored? Robots ensure safety in the handling, processing and production of materials, chemicals and equipments. Engineering work heavily rely on machinery and robots are becoming the modern world tools in production, design and processing, creating more need for the engineers to design, repair and main-tain the machines.

Food security can be addressed by smart farming, this entails use of farming robots which are precise, ensure maximum production and minimal loses for the farmer. Kenya’s manufacturing agenda can suf-ficiently be achieved by design and implementation of appropriate robots in its industries.

Across
1. Newton’s Famous paper
2. Steven Hawkin’s home
3. Circuit laws
4. Streamlined rowing device
5. One sided loop
6. Law of magnetic field generated by electric current.
7. Motion of viscous fluid equation.
8. Momentum
9. Electricity production equipment
10. Irrigation method
11. Steel reinforcement
12. Speed of sound in air

Down
1. Leaning structure.
2. Ideal engine
3. Extraterrestrial
4. Hydraulic Conductivity test
5. Ft = MV²
6. Charged electron.
7. Second Greek letter
8. Parenting body in Kenya
9. Links in chemical equations
10. Electromagnetism
11. Pressure equals

ENGINNEER’S PUZZLE
BACKGROUND INFORMATION

Citizens and business people use the Likoni ferry to cross the ocean to and fro mainland.

The Likoni Ferry is a boat service across the Kilindini Harbor that serves both the Mombasa City and the Kenyan mainland town of Likoni. Thousands of passengers use it on a daily basis. The ferry does not only serve pedestrians but also cars, trailers, tankers, buses as well as animals. It is, therefore, very important to everyone in the region. Without the ferry, most services will stop including children who depend on it to go to school and this clearly shows the importance of the ferry to our economy especially during rush.

SOLUTION

Instead of the long queue and jam at the Likoni ferry we can have a continuous road inform of a bridge. A bridge that will be able to allow the ships to pass to and fro KPA and also allow pedestrians and vehicles to move between the lands. Truss bridge, arch bridge, beam bridge, cable stayed bridge, cantilever bridge, tied arch bridge are not suitable for the Likoni since the town is too small and to construct any of this bridges, a lot of space will be needed for proper reinforcement and that's what's lacking.

A four tower/pillar bridge automated the solution. In the four pillars the bridge has got driver systems that will be able to lift it up and down. There is a motor driver and a pneumatic system. Tension cables also help in positioning the bridge to the required height and also helps during lifting and lowering. The two main systems being motor and pneumatics operate simultaneously in that one at a time and the operation of one does not affect the other system. The connections are similar to the flywheel principle whereby the gears are only engaged when necessary. The drivers are placed vertically opposite to the other for efficiency and balance. Apart from the mechanical components visible in the drawing, this bridge has got a control circuit for an alarm and the automation for all its functions in that it won't need anyone to control it. It will just be set up and the rest of work will be done by machine.

This bridge will ensure no more jams and unnecessary delays at the ferry Likoni.
Ever attended that lecture where the lecturer comes a couple of minutes late and then bursts out saying “Today we’ll talk about time management!” then students rip out there notebooks and scribble some notes on them? Well, at least the first row. If you have been in the school of engineering long enough by now you already know that timely accomplishment of anything is only possible with movies & series. Perhaps the art of last minute is the only ‘art’ eligible in the school of engineering.

The beginning of a semester has been likened to the start of the year whereby minds are fresh and ready to do extraordinary work this time. Resolutions are set; just as any normal human being who desires progress. The ambience in the school of engineering is relaxed; people discussing, among other things, about how Albert Einstein flopped in school but is still widely remembered. Everyone is at the same level. Just the school we all dreamt about. Before long this euphoric bubble is punctured when you realize there are 6 assignments, 2 project proposals (yours and your crush) and 2 cats due the next day. It’s at this point that you discover you are about 8 weeks into the 13 week semester!

Again, just as any normal human being we look back to identify the cause of our predicament. We realize that we had many chances to finish all the work. Especially that day when all of the lecturers bailed on classes and you crafted a plan to finish all work only to leave it outside the door when you got to your room.

Now that all reason and sanity is thrown outside the window, you flip your laptop and voila! “Previously on…” At this point in time the your archenemy is that part of your mind that is trying to remind you of the plan you crafted and as if that’s not enough, in the transition of episodes when the screen goes black, you get a chance of a lifetime to see yourself on the laptop screen, make eye contact with yourself, see what you’ve become and take a U-turn, but just when you start powering up your will, “Previously on…” What happened next cannot be explained, you just rather be at the beach. In the midst of all the life auditing you realize that you’ve become a little better in the ‘art of last minute’.

Mastering the ‘art of last minute’ requires one to acknowledge that knowing oneself is key. Acknowledging that there are specific times each of us works best and utilizing such times. If one forgets all that has been taught in mastering the art of last minute he or she must remember the third law of thermodynamics “your room never gets any cleaner”. Life will always tend to chaos unless some force is applied and so will engineering. With all that said, the art of last minute is a crucial skill to have in the school of engineering.