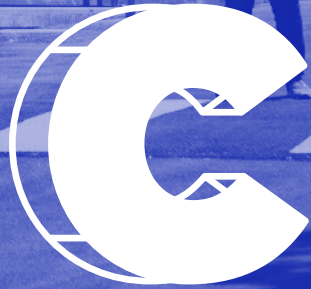




ISSUE 1 SPRING 2019

COGS & CAFFEINE



GRAPHIC DESIGN CLASS OF 2020

COMMUNICATION DESIGN, PUBLICATION DESIGN,
PACKAGING AND ENVIRONMENTAL DESIGN



Giorgia Labaki



Dana Bahri, Nour Zahabi, Rana Tawil, Yasmine Mansour.



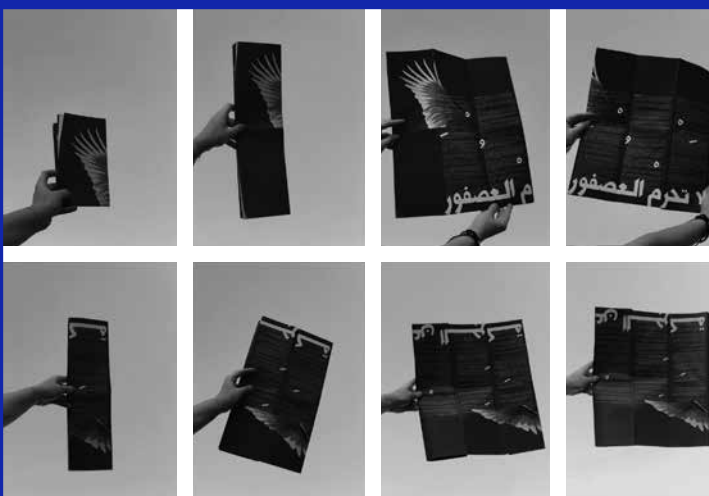
Assile Chehab, Dana Bahri, Mira Khoury.



Assile Chehab, Dana Bahri, Mira Khoury.



Nour Zahabi



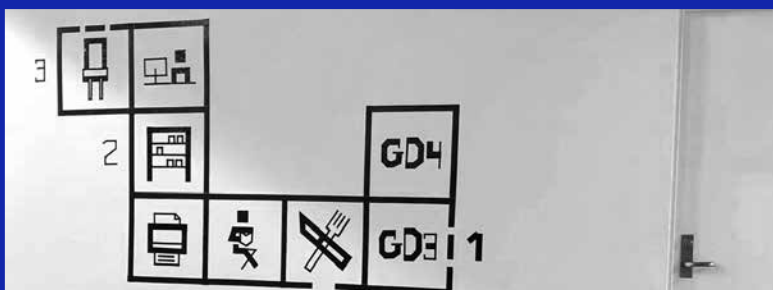
Reina Hasbini



Elham El Zaim, Giorgia Labaki, Nour Nehme, Saheer Ghazawi.



Lynn Asri, Roseline Jabbour, Yasmine Mansour, Youma Mouti



Aya Khalifeh, Rana Tawil, Fatema Taher, Sarah Najem.

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Aimed at bringing MSFEA's countless success stories to light, Cogs & Caffeine (C&C) is the start of an experiment by MSFEA's Communication Hub, run by students themselves across various programs within the faculty. We hope the stories collected in this first edition of C&C will shed fascinating new light on MSFEA's distinguished presence and impact.

Mia Azar, MSFEA Communications Officer & Lecturer

Founder's Note

Dear readers,

During my time at AUB in general, and Maroun Semaan Faculty of Engineering and Architecture in specific, I have witnessed a lot of great achievements which built upon a long time legacy and history of success, leadership, and progressive change. Our fellow students juggled everything from fantastic initiatives, to groundbreaking projects, research, and inventions. The transformative role of MSFEA in the university and society is the product of determined students taking advantage of the resources provided by administrators and stellar Professor. This has truly been a hub championing both self-development and the development of our overall community.

With such a volume of student accomplishments matched with a new faculty-wide spirit of change on an educational, social, and technical level adopted, a new need has risen. A need to found a platform, with a huge outreach, that reflects this reinvigorated innovational and entrepreneurial ethos. This magazine will also shed light on initiatives, events and hard-working individuals.

I am honored to share with you the first issue of Cogs and Caffeine, a magazine for the MSFEA. This magazine is led by a team of MSFEA students with different skills sets, majors, and interests who worked tirelessly to make this first issue- hopefully, a successful one. We wanted this magazine to be an inspiration to current and future students in general and, more specifically our colleagues in AUB and MSFEA. We wanted this magazine to play the role of mediator between promising projects and interested investors- merging entrepreneurship and social awareness. This first issue aims to capture the academic and student-centric elements the MSFEA so uniquely boasts.

Finally, I would like to acknowledge each and every member of the team for their momentous efforts. Also, we would like to extend a big thanks to MSFEA for their constant help and support, especially the communication officer, Mrs. Mia Azar, for her continuous guidance throughout the whole process.

Whether you're a writer, reader, or a featured individual in the magazine, I hope you enjoy this magazine half as much as we enjoyed preparing it for you.

To many more issues to come.

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Maroun Semaan Faculty
of Engineering and Architecture

MSFEA advising center revamped: a vision unfolding in an initiative

Mohamad Abul Hassan

Among the myriad of initiatives and transformations being implemented at the Maroun Semaan faculty of Engineering and Architecture (MSFEA) to refine and enhance student experience, came the unveiling of the totally revamped MSFEA Advising center. This initiative included a totally unprecedented and very progressive move within AUB; the incorporation of peer support at its very core. During the early days of the Fall 2018/2019 semester, a special room was dedicated for student advisors working under the umbrella of the initiative, beneath the auspices of the Work Study Program (WSP). The intention was turning advising in the faculty into a multilayered operation with fellow students representing the first layer.

To better understand the various aspects related to the new system, it was imperative to sit down with one of the students themselves, and for that purpose I sought Ali Zeineddine for my inquiries, a 3rd year CCE student involved with the new concept from the beginning. Ali begins by describing the role they play, which is to offer general advice, suggestions, help refer students to relevant departments, ease registration worries and act as a link with capacity issues. Looking back, Ali concludes that, indeed, the MSFEA advising center holds great benefits, reaped by all involved members of the MSFEA family.

For instance, through his experience spanning two semesters, he has personally witnessed the impact on his peers and friends, who no longer avoid seeking advice as it became a step closer to them. They would no longer hesitate to bring up questions on topics that might be perceived as less important or relevant, such as clubs to join or university sports, amongst other things, as a fellow student would be much better positioned to extend personal suggestions than busy faculty members, particularly for newly admitted students in need of such insight or perspective. Ali describes the opportunity he has been provided as unique and delightful, as the nature of the job, helping people, is something that he relishes. Additionally, he describes his appreciation for the responsibility and liability student advisors face with the information they provide, which was indeed one of the topics I wanted to inquire about. He thus assures me that

they always stick to the official AUB catalogue when providing any information, and immediately refer to the other elements making up the Advising Center when facing any doubt. Faculty and staff advisors did indeed benefit as well, by being offered the chance of fulfilling their role more efficiently, prioritizing cases that actively require their intervention, as well as indeed gaining a new perspective.

In this updated structure, the staff as one of the layers play a vital and necessary role, guiding the students with issues pertaining to rules and regulations, helping them with their petitions and informing them about available opportunities; while faculty advisors seek to offer academic guidance with regard to course content, minors, different focus areas and tracks as well as internship choices and research possibilities. As such, with all layers coming together, the MSFEA advising center cements its central role in guaranteeing a comfortable journey for the faculty's students.

Finally, and perhaps most importantly, this initiative is one of many that have directly contributed to a more communitarian atmosphere at MSFEA across the board. Through the ways in which it has proven its potential, it has pushed other faculties to begin thinking about implementing a similar model, and students to demand campus-wide implementation through a pending USFC proposal ■



Vida Mia's Human-Centered Design Program

Dimitri Saad



All the way from Stanford University in sunny California to the Maroun Semaan Faculty of Engineering and Architecture (MSFEA) comes a professor with a mission.

Professor Vida Mia Garcia is a design coach who, despite her stay being only temporary, has already propelled MSFEA forward to not only educate students from a technical perspective, but also empower them on a personal level.

Professor Vida Mia is an expert in human-centered design (HCD), which teaches participants how to translate requirements into meaningful ideas, in order for them to act and design adequate solutions. However, accomplishing the former requires an understanding of people and their needs. Professor Vida Mia guides people to do that, as she empowers them to suggest and execute plans aimed towards good solutions.

The design she teaches goes beyond disciplines and works as a complement to them. It attempts to make students more creative and confident since, at its core, design is not a special skill; it's something done every day. And if people were aware of the natural intersection between life and design, then that would make all the difference.

Although Professor Vida Mia's career in design seems like a natural fit now, her career did not begin as most readers would expect. Towards the end of

her PhD studies in modern literature, she realized that being a traditional professor in literature was not the profession she wanted to have. In fact, it was not the field that suited her unique ability to get people to open up and share their stories; a talent rooted in sincere humane compassion. That ultimately led Professor Vida Mia to employ her talents at Stanford's d-school, which trains people to reach their creative potential and make an impact through design. She ended up joining AUB as a visiting professor, which was an individual opportunity that embodied her professional goals. She was ready to take on the position at AUB.

THE DESIGN SHE TEACHES GOES BEYOND DISCIPLINES AND WORKS AS A COMPLEMENT TO THEM.

IT ATTEMPTS TO MAKE STUDENTS MORE CREATIVE AND CONFIDENT SINCE, AT ITS CORE, DESIGN IS NOT A SPECIAL SKILL; IT'S SOMETHING DONE EVERY DAY.

During her time at AUB, Professor Vida Mia held design workshops, as well as created the ENMG 698E course, an introduction to human-centered design. She has also presented the faculty with numerous initiatives aligned with Dean Alan Shihadeh's vision for MSFEA. The first is curricular integration, where elements of HCD are taught in courses to help students tackle challenges in different ways. The second is building an environment that encourages active collaborative work and ultimately connects people. Vida Mia believes that the environment plays a key role in how people go about their daily lives, and it is thus imperative that they are able to shape it in the way that they want. It comes as no surprise that she has since transformed what was formerly a conference room in Bechtel into a creative space for externalized thinking and brainstorming. The third and final initiative is aimed at capacity building, an initiative where students and faculty members are trained to carry on these methods by themselves.

The key to understanding HCD techniques is to acknowledge that they cannot be standardized to any problem. Heuristics and models can be helpful, but part of the process in tackling problems is the time required to gain comprehension, empathy, and the desire to help.

When asked of the importance of design thinking, Vida Mia stressed on the vitality of soft skills. Technical skills must be paired with the ability to move and persuade, which requires being able to understand people and wanting to solve their problems. Through these HCD techniques, she aims to educate a generation that is as audacious in acting as they are in thinking. Despite the magnitude of the gains presented by HCD, she emphasized the fact that such courses must not be mandatory, since they should not be forced on anybody. Students must be the ones to choose to take the course and show up for it; having it any other way would defeat the spirit of such courses.

Professor Vida Mia is excited to remain another academic year. She thinks that MSFEA can become a beacon for transformative education worldwide, to show what engineering education can do for students and, for world. To have such enthusiasm and desire to give and empower is truly a great addition to this faculty. She has already inspired many to strive to do more and believe that we can enact change towards the conflicts we encounter daily.

In her limited stay in AUB thus far, Professor Vida Mia has already left her mark ■



All Girls Code

Ryan Gharios

How did the All-Girls-Code process go?

Aya I was taking a software engineering lab course at the time, in my first year. In a class of definitely more than twenty-five students, I was one of only two girls.

Maya At the time, I was enrolled in LAU Beirut and have transferred since. But in the software engineering course I was taking in my first semester as well, we were also only two girls in a class of around forty people. In lab settings, it was down to one girl per section, with many evidently being all-male.

Aya And even in spite of unfavorable conditions stacked against the lonesome one or two female students in class, there was a complete lack of any support system. A girl I had met in my first semester ended up dropping out.

Maya A wave of transfers like this began from STEM-focused majors, to disciplines that are regarded generally as more female-friendly, in a way.

What about female-led mentorship on campus?

Which begs the question: how many female faculty members are there at the CCE/ECE department at AUB?

Aya There are Dr. Rouwaida Kanj, Dr. Mariette Awad, and Dr. Lama Hamandi. Three faculty members all in all, out of definitely more than thirty.

So 10% would count as a conservative estimate. Back to the trigger behind your initiative.

Aya We just decided to do something about it. We came up with a purely volunteer-based model.

Maya The best part about this is the integration that results from it. You then have people who are integrating concepts from coding and technology generally across the areas they ultimately choose to concentrate it, be it in environmental health or public administration and so on.

Aya Again, this was really a driving point for us, to get girls to embrace tech majors, or if that does not end up being the case, to get them to use tools such as coding – generally seen as male-oriented – to problems they encounter in other majors. We also implemented a mentorship program for our students in the boot camps or otherwise to encourage them to reach out with any questions or concerns they might have.

And where have your mentees ended up since the inception of the program?

Aya Around 90% of them end up going into STEM fields.

So you keep track of the alumni?

Maya Yes, a sizeable number even ends up in AUB very often. And they pay it forward by serving as mentors and volunteers with the initiative. It becomes



a tight-knit community over time, and our mentees tend to keep in touch through social media & so on.

So results are beautiful, to say the least. What about the preparation, the grind, and the hours?

Maya A ton of hours. What helps is that we usually organize the boot camps in summer and winter breaks. During the semester, it has to do more with strategizing and planning, so it becomes slightly more bearable. The grunt work mostly always happens in between semesters. We got used to it more over time – our first event was particularly hectic.

Aya We spent so much time up to that point in Urbanista that the waiters there ended up memorizing our orders.

Maya It was especially hard to be taken seriously too, initially.

Aya To people, we were a couple of eighteen-year olds, and we did get some goodwill promises here and there for help, but that almost never panned out. Everything took significantly more time than it should have because of this, because we kept running into roadblocks like sponsorship contracts and operational concerns.

I really want to ask you how did you come up with the curricular development for All Girls Code? This was by far the most impressive feat when looking at your website or hearing about the success of your boot camps.

Maya From experience mainly. For instance, our first workshops would mainly revolve around building your own website – the broad outline of it.

Aya The program we teach them during that first session, HTML CSS, is relatively easily digestible because the syntax is accessible for most non-tech backgrounds as well as absolute beginners.

Maya The interesting stuff happens later. Things like C++, Matlab, Java. We decided on C++, for example, because it is arguably the most object-oriented, and mostly everyone has to learn it in an engineering curriculum at university.

Aya We organized the curriculum from scratch. Mainly, we had to think about the code beforehand, test it, make sure it works, and then teach it. Importantly, we always had to link the code to some real-world concern, like cancer genomics, for instance, or environmental concerns, and so on. We also then run teaching sessions for the volunteers who will be helping out on that day.

What about the volunteer-to-mentee ratio? I mean: how much one-on-one time do mentees get at these classes?

Aya We ensure students get a high degree of one-on-one attention. For example, a class of around ten students would always have four volunteers rotating, at the least.

Maya One or two would be handling the explanations on the board. The others would be rotating around the desks and answering student questions as they arise.

Perfect. All things considered now, I want to ask you about the driving question behind the initiative. What I mean is: what are the particular points you felt impeded women from STEM – and software in particular – and how did you go about addressing them?

Aya Lack of support among parents, definitely a main pain point. No role models for girls growing up either.

Maya Exactly, as a girl interested in STEM, you do not hear about other girls who jumped through the hoops of a STEM education. For example, we addressed this during our workshops by always introducing our attendees to women pioneers in the sciences, and even got some to speak at our events.

Anything else that jumps to mind?

Aya Sisterhood is a big thing, too.

Maya The very few female students who end up studying CCE are, for the most part, not usually the best of friends. Strained relationships like these are a shame, because the loneliness of the struggle would be much alleviated if girls could share their experiences with one another and maybe draw each-others' strengths, in a way ■



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OF ONLY TWO GIRLS.**

Yara Maria Khalife

Abdulaziz Abi Haydar

In a university that dominates the Middle-East in achievements, a rising civil engineer by the name of Yara Maria Khalifeh has managed to stand out amongst her peers.

Yara chose to study civil engineering because she was fascinated by the challenge of what she calls 'big' and 'mega' projects that are inherent to the civil engineering discipline. She always imagined herself at the thick of those works.

Never one to rest on her laurels, after consistently finding herself on the dean's honors list, Yara went in search of a new challenge in her life, consulting, in which she managed to be the only women, and one of seven students to be accepted for an internship at Bain & Company this summer. An entrepreneur at heart, Yara feels that consulting will help her develop the skills to become one. She hopes to combine her civil engineering knowledge, and consulting experience in her future works.

Yara aspires to become a role model for young women in the Middle-East looking for a career in consultancy, as she found very few women partners in Bain to look up to. As she states, she wants to work on gender equality in the Middle-East. Yara feels that working in a male dominated work environment is a challenge that she relishes, and she affirms that the few women she met in Bain were amazing, resourceful, smart, and she looks forward to look up to them and emulate them.

On another note, Yara was this year's BEYMUN secretary general, the biggest model United Nations conference in the region. Having discovered BEYMUN in her sophomore year, where she was given the committee's coordinator position, Yara steadily rose to become secretary general this

year. She looked to improve the marketing, design, logistics of the conference and she ventured into online marketing. She spearheaded the establishment of a new website and application, and managed to successfully attract a record number of international delegates attending the conference.

Yara feels that her role as secretary general was the highlight of an amazing AUB experience, and that her team, all 100 of them, but specifically her secretariat, were of amazing help. She is proud to have had the privilege of leading such an amazing group of people. The young civil engineer sees that her role helped her discover how to accommodate different people and their work ethics, and how to manage the work of 11 different teams. She had to supervise the work of different teams, and make sure they are working in sync towards the goal they set out to accomplish. Yara does not wish to be the kind of leader that people are afraid of, she aspires to be approachable, and have a good and friendly relationship with her team.

Ms. Khalifeh was also the events officer of the American Society of Civil Engineers (ASCE) in AUB in one of its most successful years, where they won best ASCE chapter in the world. She organized the first volunteering travel trip in ASCE, where the society traveled to Sri Lanka, which was also an amazing success. She was later appointed as Vice-President of the society, however, her role as secretary general made it impossible to manage both positions. She ended up choosing BEYMUN with a heavy heart in order to advocate diplomacy in the troubled region of the Middle-East.

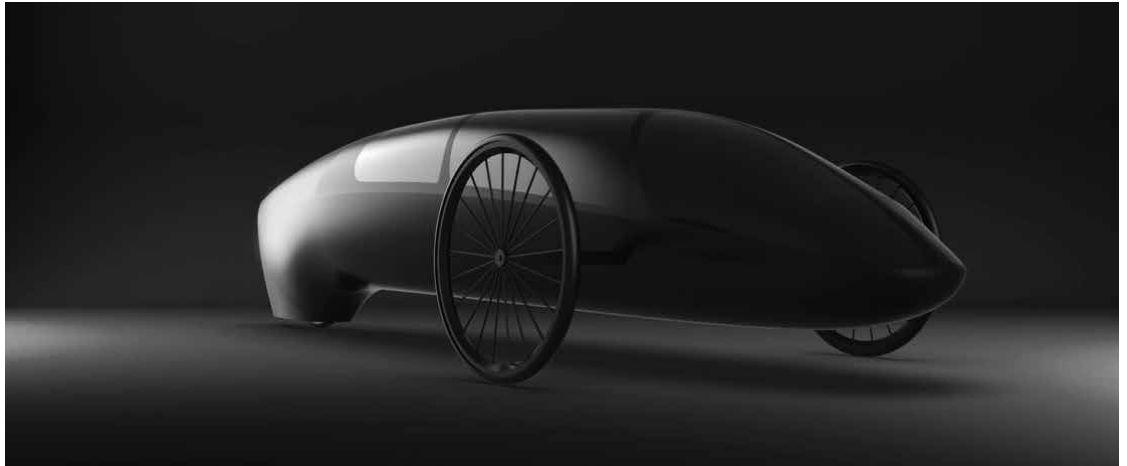
Yara Maria Khalifeh has truly not left much to accomplish in AUB ■



Mechanical Engineering

FYP: supermileage car

Jana Farhat



One of the most interesting and ambitious Final Year Projects in the Mechanical Engineering (ME) department and the Maroun Semaan Faculty of Engineering and Architecture (MSFEA) is the Supermileage car. The project has been worked on for several years, aiming to optimize it and perform in the best possible way in competitions. The FYP adviser is Dr. Harb from the ME department. This year's team consists of six members: Odette Deeba, Youssef Karam, Antoine Farah, Michel Raad, Michel Azar and Marc Grondier. We interviewed Youssef Karam, who has been working on the car for more than one academic year, to learn more about it.

Can you tell us a bit about the FYP and its objectives?

Our FYP is the Supermileage vehicle. We are trying to be build the most efficient vehicle using the traditional internal combustion engine and without the intervention of any electrical power trains. We have been competing in international competitions since 2012. Last year, we were 9th in the world in the SAE Supermileage competition in the US.

What were the alterations done on the SAE car relatively to last year?

Last year, the team completely built the car from scratch: we bought the engine, we built the body... but the team didn't have time to optimize the vehicle, so this is what we're aiming for this year. We tried to reduce the weight as much as possible, we estimate around 20 kilograms in weight reduction. There are also aerodynamics modifications for better performance of the vehicle in the wind. We also changed a lot in the drive train: the chain frequent displacement and the gear misalignment that was negatively affecting the performance, and there was power loss that could be avoided. In addition, we improved the visibility of the driver inside the vehicle.

Will you be competing in the states this year too?

This year we will be competing in the SAE Supermileage competition in Michigan the United States on June 7th and 8th. We are currently setting up everything before shipping the car to the US and we are hoping to perform well this year too.

What is next for the SAE Supermileage car?

Based on our performance in this year's competition and on the problems that we will be facing, we will see what can be done for next year. But what we would advise next year's team to do is rebuild the whole monocoque again because while doing CFD simulations this year, we concluded that the vehicle should have been longer for better aerodynamics and for driver comfort. Also, there would be more room for the engine and it would be easier for the team to work on it. We would advise to have the wheels inside of the car rather than outside of it and to look for bearings with less friction. The last thing that the next team could do is engine modifications: we tried to modify as much as we can this year, but this is a bit hard considering the lack of adequate

equipment in Lebanon. Engine modifications could start from the ECU or Electric Control Unit of the engine that controls the air to fuel ratio to reduce fuel consumption. Also, what could be altered is the ignition timing, changing it can improve the efficiency of the engine. There are many parts that could be modified, the piston can be reduced a bit in size to have less friction with the cylinder walls. In fact, most of the losses are friction losses, whether they occur in the engine or the hub or between the wheels and the ground, as well as wind resistance. Finally, I wanted to suggest for the next steps, to look again for Michelin tires that the company used to produce especially for supermileage vehicles, these would improve the performance a lot, especially since it would improve slippage which is a problem we faced in last year's competition ■

ONE OF THE MOST INTERESTING AND AMBITIOUS FINAL YEAR PROJECTS IN THE MECHANICAL ENGINEERING (ME) DEPARTMENT IN THE MAROUN SEMAAN FACULTY OF ENGINEERING AND ARCHITECTURE (MSFEA) IS THE SUPER-MILEAGE CAR.



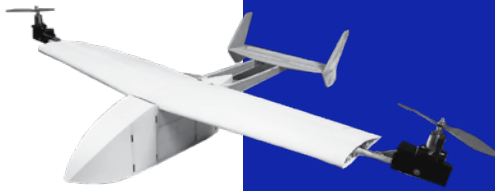
First responder VTOL Aircraft (FYP)

Tarek El Masri

When it comes to the field of aerospace engineering, Lebanon is lacking in terms of innovation and contribution. It is unfortunate that the academic and professional climate in Lebanon generally fails to encourage students to seek careers or work on projects relating to aerospace engineering, despite it being a very

promising field. A group of final year mechanical engineering students at AUB have decided to rise above the discouraging climate in Lebanon by working on a First Responder VTOL Aircraft as their final year project (FYP). The team consists of Lara Hachem, Jihane Madi, Ghassan Mouhaidly, and Ahmad Obeid. They work under the guidance

and supervision of Dr. Mohammad Harb, an assistant professor of mechanical engineering at AUB. The project is also one of the several projects being completed by members of the Lebanese Automotive and Aerospace Engineering Society (LAAES).



Increase in traffic congestion and the declining state of the infrastructure in Lebanon have made it very challenging to transport medical equipment in emergency situations, especially to hospitals and remote areas. This inspired the FYP team to look to the skies and begin working on Zephyr, a Vertical Take-Off and Landing (VTOL) aircraft that acts as a first responder and transports this critical medical equipment during emergencies.

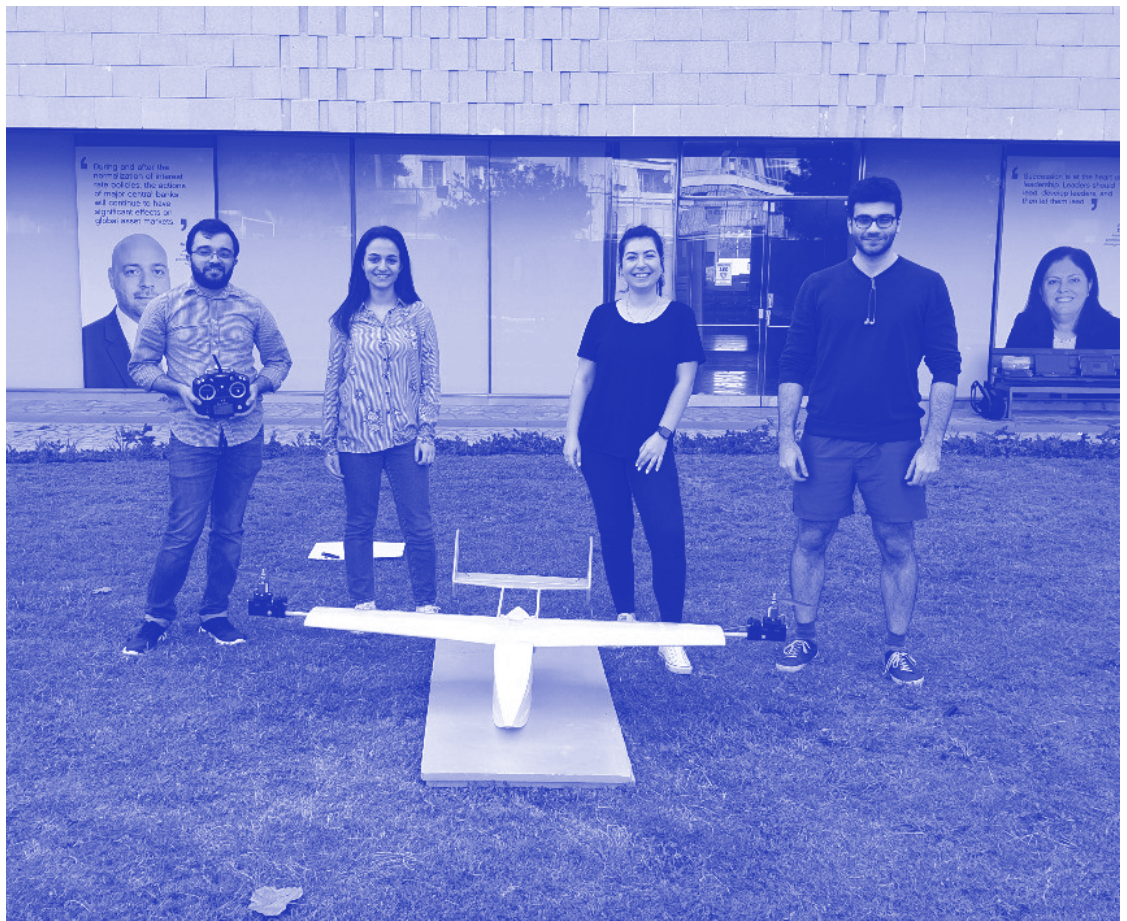
ZEPHYR IS DESIGNED TO TRANSPORT MEDICAL EQUIPMENT AND SUPPLIES DURING EMERGENCY SITUATIONS.

Zephyr was intelligently designed to accomplish its intended task. The aircraft, which has a motor on each wing, is capable of both hovering and forward flight, with the transition between modes requiring only 3 seconds. These features allow it to combine the advantages of both drones and traditional airplanes. Its ability to take off and land vertically also eliminates the need for runways or specific stations, making it very convenient for emergency situations. In addition, the aircraft

has a very lightweight, reliable, and aerodynamic design, which strives to reduce drag and make the aircraft as efficient and functional as possible. Zephyr is also environmentally-friendly, since it is fully electric and produces zero emissions during operation.

Zephyr is currently remote-controlled. Its current transmitter allows for a control range of up to 1 kilometre. The team hopes that it can eventually be made fully autonomous by another team in the future. This can be achieved using signal boosters and the appropriate control system modifications. The aircraft's stability is maintained by the tail, as well as the onboard gyro and accelerometer, using a dedicated flight controller with an onboard position feedback system. Despite the design lacking a rudder, the aircraft is capable of achieving yaw motions by having one motor rotate to face forward and the other backward, thus creating a moment that produces the appropriate yaw. Avoiding the use of a rudder saves weight and spares the designers additional control system burdens. As mentioned earlier, Zephyr is designed to transport medical equipment and supplies during emergency situations. It can be used to transport AED kits,

insulin pens, oxygen masks, first aid kits, etc... This equipment can be stored in its spacious cargo area, which is easily accessible through magnetic doors. With its currently installed motors, the aircraft can carry up to 2 kg in addition to its own weight. The design allows for ease of motor replacement with new motors or stronger motors that can produce more thrust and carry more weight. As shown in this article, Zephyr is a reliable, cost-efficient, and effective aircraft that can be used for aerial transport of medical equipment during emergencies. The current team would like to see another team in the future continue developing the VTOL aircraft for their own FYP. They hope that the aircraft can eventually be made fully autonomous and hope to see a more optimised final design. This is a very interesting opportunity for students interested in aeronautics, since they would be applying their design and control skills while working on an ambitious aircraft with a humanitarian purpose ■



FYP: “Autonomous Self-Balancing Electric Bicycle”

Dalia Bekdache

Like many other fourth year students deciding on what to work on as their final year project, Mohamad, Sara, and Walid set out to target a professor for their work. They chose Dr. Naseem Daher, as they were interested in working on a project related to vehicle automation. Because their team presented the best potential idea and feasible knowledge of the project, they were chosen to take the lead on this challenge. The theoretical specialty of this prototype is that not only would it act autonomously through predetermined navigation, but it would also balance itself during motion and rest, with or without a passenger. This project ultimately focuses on several factors: hybridizing commercial vehicles - which drastically reduces pollution because of the absence of engines - self-governing.

Mohamad Kanj, Sara Alawieh, and Walid Al Jaroudi are fourth year Mechanical Engineering students at the American University of Beirut, who were passed on the challenge of the Final Year Project (FYP) to design and program a self-balancing and autonomous bicycle. This Final Year Project was previously led by a group of fourth year ECE major students, and this year it was given to mechanical engineering major students to help improve and complete it. With the help of Dr. Naseem Daher as the advisor of the project, who is an Assistant Professor for both ECE and ME departments, it was decided that such a project could use the help of mechanical engineering students since their major is interdisciplinary with the ECE major. Students are equally capable of solving mechanical and electrical challenges. navigation, and using the 'Bicycle Model' which could eventually be implemented on commercial vehicles. The Bicycle Model is the model responsible for the mechanics and controls for cars, motorcycles, and bicycles alike, such as the programming of the steering angle, as well as the dynamics such as the relation between speed and steering...etc



THEIR JOB WAS TO WORK ON A BICYCLE PROTOTYPE WHICH COULD BE USED EFFORTLESSLY TO EASE THE MODE OF TRANSPORTATION



Encouraged and motivated by their advisor, the team of three were given the amazing opportunity to develop the bicycle prototype through generous funding from the LIRA program, which is a “national council for scientific research”. They provide sponsorships to projects that deserve to be further investigated, led by the Ministry of Industry, as well as an industrial partner (S. & A.S. Co. Ltd). This allowed them to purchase sophisticated sensors, such as a stereo camera, GPS, IMU (Inertial measurement unit), ground speed sensor,

NVidia Jetson (which is the brain of the bike) that would be of great use to their project. The bicycle was initially bought by the original team led by ECE major students along with an electric wheel, while the rest of the mechanisms were manufactured as per design. All necessary electrical hardware was bought by Mohamad, Sara and Walid through the funding. Working for at most 7 hours per day, 5 days a week, each team member focused on specific aspects of the project: Mohamad was responsible for Perception and SLAM (simultaneous localization and

mapping), Sara was responsible for Self-balancing and Automation for navigation, and Waleed was responsible for Path Planning and Motion Planning. Computer operating systems and programs such as ROS Kinetic, C++, Python, Arduino and Matlab were used to program the necessary controls. As for the team’s progress, they have mentioned: “With the equipment we gathered and bought, we have developed till now the programs that would allow a person, or in this case a bike, to map a certain environment and localize, meaning it would know exactly

where it is positioned in a certain map or environment through a stereo camera. Once a final destination is selected, it would create a path on its own and initialize steering and velocity commands that would make it reach this goal. We have also incorporated a GPS sensor, and an inertial measurement unit (IMU) to further assist this autonomous driving. On another end, programs have also been developed by the team using specific models to make the bike self-balance using customized control schemes.” As a next step, the team believes

that the rest of the work could be taken over by ECE majors again, as they think that they may have found a solution to the mechanical problems of stabilizing the bicycle. What’s left may only be a matter of programming and control. If more fourth year teams take on this project in the next couple of years, Mohamad, Sara and Walid, along with Dr. Naseem Daher, believe that the bicycle could eventually become mass produced ■

Chemical Engineering

FYPs in chemical engineering

Ryan Gharios

Final Year Projects (FYP) in the Chemical Engineering Department at AUB are significantly different from the usual product design undertakings in MECH or app development in CCE. Since its inception, the program has focused its capstone projects on simulations and process design, albeit with an eye constantly on real-world applicability. Unfortunately for Lebanon, this end-goal is the waste crisis that has been ravaging the country for the better part of four years.

In an effort to ground FYPs in a concrete, real-world issue, most assignments have to do with the utilization of the biomass content in municipal solid waste to form value-added compounds. These end-products are most often fundamental compounds such as ethylene, propylene, and

acetaldehyde, but could also be a pharmaceutical compound or other specialty chemical. Group-to-group variation kicks in downstream, where different commodity outputs require vastly diverging processing routes and strategies. For a rough outline, most projects start with

a rigorous analysis and modeling procedure of the biomass derived from municipal waste on chemical engineering students' (favorite) simulation software: Aspen PLUS. The extent to which this upstream work is done accurately is a good metric of just how realistic end-results shape up to be.

IT IS AT THIS POINT THAT THE CHEMISTRY ACTUALLY KICKS IN **TREATING SOLID WASTES AND TURNING THEM INTO VALUE-ADDED PRODUCTS** MOST USUALLY IMPLIES EXTRACTING THE VALUABLE CHEMICALS IN THEM AND TRANSFORMING THEM INTO A MORE “**PROCESS-FRIENDLY**” COMPOUND.

That core technology is called gasification and the resultant gas is commonly referred to in industry circles as syngas. Gasification is a promising technology for the treatment of extensive quantities of wastes, and as such makes sense as a core platform to use in process design. It involves treatment at markedly high temperatures ($> 700^{\circ}\text{C}$) and pressures to result in a carbon monoxide and hydrogen rich-gas, which then undergoes a series of unit processes of its own in order to be converted into the product of interest. Ultimately, final presentations shape up to be pitches more than rigorous technical exposés per se – student groups are usually expected to supplement their

design (involving everything from initial preliminary work to process control and heat and mass integration) with extra analyses such as rigorous economic planning, safety considerations, environmental concerns, plant layout and location, amongst others. Common evaluative metrics are those that are industry-prevalent: descriptive numbers such as conversion and yield could very well indicate technical feasibility (or lack thereof) – however, they are by no means the only measure of good design. In fact, supplemental considerations, even those that are seemingly trivial such as product transport and feed material costing, should all be part of a substantive design report. How well a

certain group executes on the above fronts is a key differentiator between innovation and adoption.

Finally, diving headfirst into an undertaking such as a full-blown process design is most always a nauseating experience. However, as an amalgamation of practically every course that has come before it, it serves as a rigorous capstone and summary of lessons learned over the span of the degree. It should be noted, however, that some controversy does exist regarding its continued implementation, as it does feel at many instances as a re-invention of the wheel. Granted, most designs tasked to students are previously unpublished, but almost all of the prompts have been

answered and are documented in the annals of large chemical companies and other academic bodies. How well the FYP simulates the real-world work experience of today's chemical engineers is a hot topic – as increasingly many feel it is divorced from the reality of the workplace, which is becoming much more product-centric and, concomitantly, revolves much less about processes and iterative simulation. Summarily, while its educational benefits are self-evident, perhaps a re-thinking of the format – specifically, what questions we are trying to solve as chemical engineers – will be necessary in the years to come for both the department and the faculty at large ■





Winner of the Dean's Creative
Achievement Award in INDE.

Industrial Engineering

No More Waiting at AUBMC

Samar Nasser

The Industrial Engineering and Management department, with its undergraduate program officially established in 2016, will be graduating its second class of Industrial Engineers this June. As the program is relatively new, the final year projects (FYPs) that Industrial Engineering undergraduates present each year are fresh and varied. Topics of this year's FYPs ranged from establishing an electric scooter sharing service to turning the Grand Factory into a sustainable nightclub. But, the Dean's Creative Achievement award in Industrial Engineering went to E4 undergrads Hammam Abu Hatab, Nadim Yatim, Zein Elabdin Zaher, and Kareem Kaddoura for their project, "Data Analytics and Simulation at AUBMC: Reducing Patient Waiting Time."

THESE FOUR INDE STUDENTS TOOK A
PROBLEM THEY PERSONALLY FACED
- DEALING WITH LONG WAITING TIMES AT
PRIVATE CLINICS - AND **TOOK THE INITIATIVE**
TO TACKLE THE ISSUE WITH THEIR
KNOWLEDGE IN SIMULATION AND DATA
ANALYTICS.

The team focused on AUBMC's Ophthalmology department and through collaboration with the department, they discovered unconventional alternatives to the waiting problem that worked to reduce patient waiting time and increase patient inflow. One of these alternatives included relocating AUBMC staff to other areas during peak hours.

The team achieved this by using data analytics techniques to find the optimal schedule for relocation and simulating the alternative with the proposed schedule to find the change in waiting time per day.

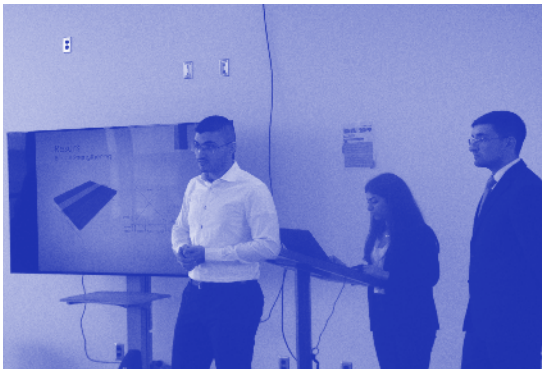
Hammam, Nadim, Zein, and Kareem will soon present their report to the Ophthalmology department for their consideration and possible implementation. Ultimately, teams like this, through their diligent work and creative solutions, are inspiring the next wave of Industrial Engineering students to have an impact on organizations and institutions throughout the region ■

Civil Engineering

LEBANON HAS ALWAYS BEEN PLAGUED WITH PROBLEMS RELATING TO **SUSTAINABILITY**. FACING THE FUTURE HEAD ON, TWO CIVIL ENGINEERING FINAL YEAR PROJECT (FYP) TEAMS LOOKED TO **INTEGRATE TWO HISTORICAL NEIGHBORHOODS INTO THE NEW CENTURY.**

Ain el Mreisseh Fishermen's Port

Yasmina Noueihed



Areen Dakessian, Ali El Haj Chehade, Charbel El Khoury and Dana Yehya are four senior Civil Engineers who tackled the rehabilitation of the Ain El Mreisseh Fisherman's Port. With the Lebanese economy slumping into a recession, and the former being a more local and popular port, these students are trying to ensure that local Lebanese fishermen will be able to sustain and perform their jobs.

To get a better understanding of the problems at hand, the students visited the port and gathered information from the fishermen themselves. They were able to narrow the problems to three main ones, which include the deterioration of reinforced concrete structures, the sewage pollution and the damage of property due to wave action. First, our Civil Engineers attempted to rehabilitate the reinforced concrete structure of the port damaged by corrosion. The students

wanted to remove the damaged material to provide the Fishermen with new fresh concrete and reinforcing bars. Not only that but they also noticed that their work environment posed a risk to their health, as the port was located at a distance of 50 meters from sewers pipe. The challenges the fishermen face, included dealing with the odors and

impurities carried by the water.

Our AUB students attempted to fix this problem by modeling a pipe with a maximum length of 120 meters that would carry the sewers away from the port and reduce the concentration of impurities to an acceptable range of recreational water.

However, they encountered another problem that affects the execution of the work of the fishermen and it concerns the crashing waves coming all the way from the North. The high amplitude in the velocity of the waves, especially in the wintertime, makes the fishermen's work less productive and more dangerous. Since

they are also facing an economic problem, they cannot afford to buy new boats that are equipped to resist these currents. The only solution was to install a breakwater (dam-like structure) and decrease the waves' frequency. Unfortunately, this approach costs just north of \$4.5M, an impossible budget to raise. The optimal recommendation would

be for the fishermen to restrain from working during the wintertime and instead be compensated by the government. Thus, throughout this project, our AUB students were able to target a socio-economic impact by scrutinizing the problems at hand and providing solutions in order to revive the Ain El Mreisseh Fishermen port ■

Sustainable and Car Free

Mar Mikhael and Gemmayze

Abdulaziz Abi Haydar



They decided to divide their plan into three phases, the pre-project planning, which includes identifying the stakeholders, the procedure of implementation, and data collection. It will be followed by the project design phase which consists of setting a circulation plan, analyzing the accessibility of the region, the road design and the environmental

considerations. Finally comes the project assessment phase containing the cost benefit analyses, conclusion and recommendations. The project will concern the residents, visitors, businesses, municipalities, ministries, property owners, political and religious institutions.

After collecting data for their project, they decided to lay down a circulation plan that

The Mar Mikhael and Gemmayze area in Beirut is perhaps the liveliest and most vibrant region in the capital. It has, however, not escaped one of the pitfalls that has haunted the Lebanese society in recent times, car traffic and air pollution at an exorbitant rate.

Four civil engineering students, Julie Aboumoussa, Nathalie Bejjani, Tania Bteish and Marcel El Khoury, decided to tackle this problem, because of the area's high population density, overwhelmingly narrow streets due to its historical past, and extremely varied land uses, from being a residential to business hub in Beirut.

makes the roads of El Arz, Gouraud, Pasteur and Armenia amongst other smaller roads pedestrian only. This plan will make most of the local landmarks sheltered from the nuisances of air pollution and car traffic.

They also set an auxiliary transit plan, composed entirely of electric buses and bikes. They will have multiple bus stations and bike stations along key locations in the district.

The civil engineers decided to give car accessibility to those that are physically and/or mentally impaired, the elderly, holders of already paid private parking spaces, and delivery vehicles (with a 10km/h speed limit). Freight transport will be allowed between 5Am and 7Am, and emergency vehicles will have constant access. The roads will be divided into 2 way, 6 meter wide, travel lanes, 2 bike lanes,

and a larger sidewalk. The implementation of this plan will have a fixed cost equal to \$12.6 million, while the yearly benefits can reach up to \$6.6 million. It would break even in two years. With Lebanon ranked as one of the most polluted, and traffic heavy countries in the Mediterranean and the Middle-East, there are worse things to do than to look into this project for a real life implementation ■

Materials FYP

Omar Badr

As one of the more diverse engineering disciplines, the Civil and Environmental Engineering (CEE) department at the American University of Beirut (AUB) generates – through its students – an assorted array of Final Year Project (FYP) topics on an annual basis.

One of the most popular sub-disciplines under CEE is the research into different construction materials. Every year a handful of CEE senior students publish extremely interesting and thought-provoking FYP papers that are concerned with different aspects of construction materials.

In spite of being one of the oldest engineering fields, we are still only scratching the surface about different materials through intensive and breakthrough research.

This year, two groups of creative and resourceful students dedicated their time to produce two distinctly well done Final Year Projects. The teams focused their attention on incorporating sustainable features and extending the life cycle of two vital construction materials, asphalt and concrete, by integrating innovative and novel materials into each material's respective mix. Listed as groups 11 and 21 in the CEE department, the teams' outstanding work was rewarded, winning, respectively, first and second place in the CEE Holcim Awards.

Formally known as 'Group No. 11', the team of Mohammad Ajeeb, Ibrahim Al-Masri, Lina Hassoun and Omar Husami were one of the most impressive.





FYP teams across the entire faculty this past year.

Under pressure to pick a topic, G11 were running out of time with 24 hours left before the deadline submission. Not knowing where to look, they finally found their answer right below their feet, literally! Contemplating what decisions to take, group members Lina and Ibrahim were overlooking Paris Street, Beirut a day before their topic submission. A quick glance onto the street yielded their topic. "There's self-healing concrete right? Then why not self-healing asphalt?" A few hours of research later and G11 found their calling. Little did they know, it was a match made in heaven.

The team's FYP was focused on Asphalt Pavement, where they studied the effect of adding steel wool fibers to asphalt mix design. Titled 'Self-Healing Asphalt Pavement Using Steel Wool Fibers', G11 tested whether the addition of steel wool improved the performance of asphalt by testing its stiffness, ductility, abrasiveness and its self-healing capacity.

After going over the topic literature and setting up their plan of action in FYP I, G11 began their work in the lab on December 13, in the middle of their winter break! Their plan was to substitute 0.5% of the weight of the asphalt mix with steel wool fibers for their test samples. To prepare their samples, the team members had to sieve around 400 kg of aggregates to make sure that the gradation of their mixes passed certain requirements. To add the fibers to their

mixes efficiently, the team had to add each fiber alone, manually, to ensure that there was no clustering of the steel fibers. This process was long and tedious; with each sample taking around an hour to prepare accordingly. The process highlighted the teams perseverance and meticulousness.

The team's engineering ingenuity also shone through during their lab preparations. Needing to heat their sample mixes to conduct their tests, the team found that the heating methods used in literature were impractical and not representative of real life scenarios. In response, the team designed their own test setup to heat their samples in a more accurate reflection of reality, using Infrared (IR) light. G11's results were extremely positive, they found that the addition of steel wool fibers improved the performance of the asphalt pavement in a multitude of ways. The pavement's

ductility increased, it became less abrasive and its self-healing ratio improved for the pavement's first healing cycle. Their results were so promising that Dr. Ghassan Chehab, Professor of civil and environmental engineering, has pushed for the research to be continued next year, where it will be picked up by a new FYP team in the hope of going even further with more testing at different percentage replacement. The team's excellence won them three different awards – The Dean's Creative Achievement Award (CAA), The Best CEE Materials FYP and Positioned first in the Holcim Awards.

Following up on the brilliant work conducted by CEE students, the team of Sarah Abi Karam, Michelle Eid, Mariam Itani and Joe Nassar – Group 21 – chose to focus their attention on the most commonly used construction material in the world, concrete. Interested in 'eco-

materials', G21 wanted to introduce sustainable methods into mainstream construction materials.

Seeing that introducing incinerators to deal with the waste issues plaguing Lebanon is a hot and current topic, G21 wanted to see if they could find viable solutions to the problems these incinerators will inevitably create.

Working towards this goal, the team decided to test the idea of incorporating incinerator ash into concrete mix design. Their FYP title followed suit, 'Eco-Cement: Incorporating Incinerator's Ash in Concrete.'

Based on their literature review, the team decided to test three different percentage replacements of cement, where they replaced 10%, 20% and 30% of the cement in the concrete mix with incinerator ash and tested the compressive strength of the resulting mixes. The team used

two different types of waste, medical waste from AUBMC's incinerator and regular home waste from a paper mill in the Beqaa region. To maintain consistent results the team sieved both types of waste on a No.100 sieve and tested each one in a separate mix. After initial iterations and tests the team saw that the ash in the mix increased its water to cement ration, rendering the concrete too weak. To facilitate the use of the ash, the team decreased the water ratio they added to the mix.

After optimizing their mix, the compressive strength tests yielded extremely positive results; both sets of mixes gave higher compressive strength values than the control samples. The 'eco-mixes' used less water than the control samples and bore higher strength values, with the optimal mix being a 10% replacement of the cement with ash. To test the concept in

a more comprehensive manner, G21 undertook preliminary tests to check if the 'eco-concrete' would leech in curing water, to determine its usability in wet conditions. Results showed that the concrete blocks with ash showed more leeching than the control samples, with some leeching of chlorides and sulphates found in the curing water. It is important to note that these results are not conclusive and only provide preliminary indications to the leaching ability of the eco-concrete.

In recognition of their exemplary work Group 21 came in second place for the Holcim Awards. The relevance of their research should be highlighted, with the potential introduction of incinerators in Lebanon; a sustainable benefit that counterweights the countless problems that arise with them may be extremely needed ■

CCE & ECE

Georges Haydar

Blockchain in Power Management Systems:

The cure to an everlasting disease?

THE YEAR IS 1992. A YEAR HAS PASSED SINCE THE END OF THE WAR AND THE GOVERNMENT IS CONTINUOUSLY REAFFIRMING THEIR PLEDGE TO REBUILD THE DEVASTATED POWER GRID SYSTEM.

Twenty-seven years later, Lebanon is in a very precarious situation. The country's electric supply is ranked fourth from last in the world, it has one of the highest prices per kWh and is subject to multiple daily outages. Nonetheless this FYP might be a game changer.

Four fourth-year students (Saadallah Sarkis (CCE), Pierre Chekrallah (CCE), Mark Moukarzel (ECE) and

Michel Kallas (CCE) came up with the idea of merging their interest in power and blockchain; a decentralized, transparent and secure public ledger update in real-time that keeps track of transactions made by different users in a network, and carefully elaborated a viable solution for a national problem that has constantly plagued the country and puzzled successive governments.

So, how does something coming straight out of The Matrix solve our electricity crisis?

The concept is very straightforward. In a traditional power grid system, the consumer is connected to a unique utility center or a power supplier (state or privately owned), thus

giving them a monopoly on the market and suppressing any chance of negotiation. With the help of blockchain technology, the grid system can be turned dynamic, wherein every consumer having solar panels or any type of renewable energy source can sell his/her excess of produced energy live on a virtual market. Millions of users, millions of transactions. This would create a greater supply of energy, thus letting people, who would become competitors to the state-owned EDL, trade at a more reasonable price than that of the state monopoly or private corporations. Consequently, this would maximize the consumer's profit and minimize expenses. A win-win situation for everyone,



right? Although such a plan would greatly help combat corruption and create a long-overdue sufficient supply of power, a lot of constraints persist.

First of all, Lebanon suffers from chronically weakened, unstable infrastructure. Since the majority of the power grid was built in the 1960s and 1970s, it has inevitably suffered from extensive deterioration

and the disastrous consequences of the civil war. Deploying such a project on the national scale would need to account for power loss and price fluctuation, something the students have already examined. Power loss would be accounted for in the price which would be proportional to power received, not power delivered and would be centered around some sort of price standard

calculated using the Nash normalized equilibrium.

Furthermore, for this FYP to fully realize its potential, it requires two crucial steps: the implementation of a smart power grid, and the design of the blockchain and an optimized model. And while the latter is a rather purely technical matter, the former will inevitably demand sufficient

national will. Nevertheless, Dr. Rouwaida Kanj, Assistant Professor in the ECE department and the students' advisor is confident that this project "can enable a secure and reliable peer to peer energy trading platform, allowing us not to solely depend on utility but to have multiple energy providers at small company levels and individual household levels, and as such, it can indeed be a great solution."

The implementation of Blockchain technology in power grid systems can thus absolutely represent a viable solution, and perhaps become the stepping stone to Lebanon's greatest and most important unrealized project: the rebuilding of its infrastructure ■

Vehicle to Vehicle

Layal Kibbi

Vehicle to Vehicle realization in smart cities, also known as V2V is the modern day solution to the issue of car crashes and road dangers. A talented team of Maroun Semaan Faculty of Engineering and Architecture students: Karim Chamseddine, Johnny El Hajj, and Nassib Khoury tackled this concept in their final year project.

ROAD TRAFFIC ACCIDENTS ARE ONE OF THE LEADING CAUSES OF DEATH IN LEBANON, RESULTING IN **1,129 DEATHS PER YEAR!** THIS TEAM WAS COMPELLED TO **REDUCE THIS NUMBER, SAVE LIVES, AND HOPEFULLY MAKE A TANGIBLE DIFFERENCE IN THE WAY WE DRIVE.**

They decided that V2V communication be a mobile phone application due to its fast notification, availability to everyone, and detection of vehicular movement. The application uses Peer-to-Peer connection to connect vehicles in the same area.

After the user downloads the application, it will compute the former's relative position and his or her's risk of collision. Following, the app will notify the user of any change of behavior from other vehicles and allow the driver to adjust the former's driving accordingly.

This notification includes any situation of changing lanes, following too closely, sudden braking, and driving blind. The application is noteworthy because there is no need to update the vehicle's hardware or software. The application is affordable, and accurate up to two meters!

When asked about his FYP experience, Karim mentioned: "It was a great experience, and you get to learn quite a lot when you work on a big scale project on the field".

The team wishes to thank the AUB community as well as the non-AUB community who helped them brainstorm and implement the application on the ground.

Currently, the team is busy pursuing different career paths. Meanwhile we will be anticipating any further work on this concept! ■

INVESTING IS ESSENTIAL TO PRESENT AND FUTURE FINANCIAL SECURITY, AS IT PROVIDES A WAY TO BOTH GROW WEALTH AND GENERATE PASSIVE INCOME.

That being said, investing is not easy as it requires a great deal of knowledge before it can be done with confidence. For that matter, many risk profiling, portfolio optimization, and stock analysis tools have been developed by companies to convince investors to let them manage their money. Unfortunately, many of these tools are not beginner friendly or educational, and require a high level of financial knowledge to be used effectively. Enter QuantInvest.

What is it?

QuantInvest is an online platform that allows beginner and advanced investors discover their financial goals, construct stock investment portfolios, and explore those portfolios and their constituents with ease.

How does it work?

We'll first ask you some questions to know what fits your investor profile - this is optional risk profiling stage. After that is completed, we'll build a portfolio for you, in such a way as to maximize returns at a risk level you're comfortable with. Once this portfolio is generated, we'll let you explore and experiment with your portfolio constituents using our stock explorer and portfolio optimizer.

Why is portfolio construction such a big deal?

Going back to basics, investing in a company generally implies acquiring that company's stocks. These stocks yield regular dividends (sums of money distributed to shareholders), which become a passive income source for the investor. Over time, the stock price changes, changing with it the net value of the investment. For example, a \$500 investment in Apple stocks in 2005 would be worth

\$23,480 in 2019. This is how an investment can grow, while providing annual dividends. Not all investments yield positive returns however, and this is where smart portfolio construction is required.

A portfolio is simply a group of financial assets. The challenge lies in owning assets that yield net positive returns. This is where portfolio optimization comes into play. One optimization strategy would be maximizing returns while minimizing volatility, or maximizing what is called the Sharpe ratio (returns over volatility). This is done by looking at past data, and choosing the portfolio which would have performed best, given our constraints, with that data.

Behind the scenes, our portfolio optimizer implements the nobel-prize winning mean-variance analysis to find optimal portfolios meeting certain constraints. One of these constraints could be a maximum acceptable risk level, another would be simply minimizing volatility, etc... QuantInvest's portfolio optimizer allow the customization of these constraints by the user. After an optimal portfolio has been generated, QuantInvest offers a portfolio explorer and stock explorer tool. This exploratory tool allows the user to gain insights about specific stocks using hand-crafted company health indicators, and learn what the different fundamentals and technical indicators mean ■



Wirelessly Powering Implantable Sensors: Electromagnetism at the Service of Human Health

Mohamad Abul Hassan



With sensors playing an ever growing and essential role in our daily lives, constituting part of everything we come across, from machinery, automobiles, aircraft, home appliances, smartphones, all the way to biomedical applications. We might often fail to realize a major fact about them: they need power. In spite of having a generally very low power consumption, this significant fact has been bugging researchers and engineers for years, leading to a significant portion of research being dedicated to securing efficient powering techniques, vital to keep battery-operated sensors running for many years, with little to no maintenance required.

This is exactly where three talented students from our faculty's ECE department come into play; Rim Cherri, Ali Hallal and Batoul El Hage. Fascinated by this field of research, they decided to dedicate their Final Year Project to it, under the supervision of Associate Professor Joseph Costantine and Assistant Professor Massoud Khraiche, with a special humanitarian dimension, for which they received the Dean's Award for Creative Achievement in Electrical and Computer Engineering at this year's IDEAS conference.

Titled "Wirelessly Powering Implantable Sensors", this FYP seeks to answer the following question: "How to combine wireless powering techniques in an efficient and enhanced implantable sensory system?"

For the purposes of this project, the choice is made for the work to revolve around the "Cochlear Implant," an electronic medical device that replaces the function of a damaged inner ear, serving to facilitate hearing experience for humans affected by profound hearing loss.

In the current cochlear implant devices, the life time of a typical rechargeable battery ranges between 6-8 hours and could reach up to 14 hours depending on the usage time. On the other hand, the transmission efficiency of the conventional coil system between external and implanted internal part of the implant is limited to 40 %. The team states its aim as to "to wirelessly charge the batteries found in the cochlear implant instead of continuously removing the batteries to charge them independently.

Aside from the usual technical constraints, special attention was to be paid throughout the project to every small detail, recognizing the potential hazards that

could be posed to the health of those making use of the new technology.

Through hard work and perseverance, beginning with an expansive literature review of more than 25 journal papers primarily on inductive coupling and RF energy harvesting, followed by multiple design suggestions and extensive testing, the team was capable of coming up with a solid proof of concept, including working designs.

“BY WIRELESS CHARGING, THE BATTERIES’ LIFETIME WILL BE EXTENDED, AND IT WOULD FACILITATE THE HEARING EXPERIENCE OF MANY PEOPLE BY NEVER LETTING THEIR BATTERIES GET DRAINED, SO THEY **DON’T GET TEMPORARILY DISCONNECTED FROM THE WORLD.**”

Architecture students design, fabricate and install a canopy at FS1 gate

Ghida Anouti

Team: Ghida Anouti, Nour Balshi, Lama Barhoumi, Sirena El Rifai, Tala Farraj, Careen Matta, Yara Mortada, Salem Shamia, Jana Semaan, Mariebelle Zoughaib

For the core project of the course Algorithm and Iteration (ARCH 060), offered during the 2019 winter session by Ahmad Nouraldeem, architecture students designed, fabricated and installed a canopy by the FS1 building entrance. The course aimed at teaching students how to use the software Grasshopper, one that provides a visual programming language and environment that is suitable for modelling parametric designs. The choice to place the installation at the entrance of the FS1

building was to provide students with the opportunity to intervene on and liven up the newly appointed space for the architecture program while the old Architecture and Design building was going to undergo renovation.

Guided by their instructor, the students designed the canopy on Grasshopper, which helped provide an optimal form within the specific measurements of the site. The digital model divided the canopy into long strips that facilitated

the fabrication process. The students produced a 1:5 scaled model of the canopy and later proceeded to fabricate the 1:1 final product. As instructor Ahmad Nouraldeem put it: “Parametric design allowed the students to take advantage of the accuracy afforded by computational design tools to introduce integrated approaches mostly based on technology, materials, site and climate responsiveness, system mechanics and economy. In this case, the students worked on generating a parametric design through Force Density Method (FDM), a minimal surface geometry. The process took place in an iterative manner with existing and calibrated constraints/variables set by the students, generating a double curved pre-stressed form”.



the fabrication process. The students produced a 1:5 scaled model of the canopy and later proceeded to fabricate the 1:1 final product. As instructor Ahmad Nouraldeem put it: “Parametric design allowed the students to take advantage of the accuracy afforded by computational design tools to introduce integrated approaches mostly based on technology, materials, site and climate responsiveness, system mechanics and economy. In this case, the students worked on generating a parametric design through Force Density Method (FDM), a minimal surface geometry. The process took place in an iterative manner with existing and calibrated constraints/variables set by the students, generating a double curved pre-stressed form”.

The process of fabrication required printing templates of the strips and tracing them on rolls of fabric. Students then hand-cut the strips of fabric and stitched together to form the complete shape. After securing steel anchors on critical points on the site, the students introduced long, steel cables through the fabric and tightly fastened them to the anchors. The canopy was then in its optimal form and tension. Fabricating and installing the canopy by hand was an intimate design experience that required critical thinking and finding efficient solutions in a short amount of time. Thanks to the support of the Department of Architecture and Design that funded parts of the cost, the students were able to fabricate and build the installation. It forms today a successful gate that enlivens the entrance to FS1 and makes it inviting to students, faculty, staff and other passers-by ■

Dean Weidner and Camille Chamoun inaugurating the Faculty of Engineering



SPOTLIGHT

FEA History

Abdulaziz Abi Haydar

From its humble beginnings as the Syrian Protestant College in 1866, to becoming the leading educational institute in the Middle-East, AUB has come a long way.

The school of engineering was established in 1951, with students previously studying in the faculty of arts and sciences, and obtaining a bachelor of science in civil engineering, as it was the only engineering discipline offered.

When the faculty was established, the majors offered were Civil, Mechanical, Electrical and Architectural engineering. However, the bulk of the student body was composed of civil engineering students. At that time, no women were allowed to attend.

Nonetheless, with the faculty's steady expansion, it slowly started incorporating women. Architecture would later be added as a standalone major, eliminating architectural engineering, and thus fully establishing FEA; the faculty of engineering and architecture.

During the first year of its inception, the faculty did not have a proper building. This led to the hasty construction of the Bechtel engineering building, which was completed within a year, and would be just enough to satisfy the needs of the faculty.

The first dean was dean Ken Weidner, who, according to Dr. George Ayoub, built the faculty from the ground up. The structure he established was so well

built, that FEA went a long time without having to undergo major structural changes.

The first students that attended the faculty always felt that they were the elite students in the region, as AUB was considered as "The elite university". Under Weidner's leadership, engineering students were excelling on all levels, from academic performance, to extracurricular activities, and to sports, they were always top notch. The school of engineering, at that time, was the top sports hub in the country, with multiple students exercising sports on a professional level. Dr. Ayoub recalls that there were a lot of extracurricular activities to be done in AUB, especially for that time period in the region.

Students back then were graded much more strictly than today, with only the top 10% of each class being placed on the Dean's honor list.

In the 1950s, the students had a stronger, and wider range of knowledge, but did not go in-depth during their studies. This was due to the nature of the job market, which at that time, in the Middle-East, expected engineers to be jack-of-all trades individuals.

According to Dr. Ayoub, three important things were expected from the biggest engineering group at that time, civil engineers:

1. Good handwriting
2. Surveying
3. Quantity take-off

There was an emphasis that graduating engineers should be organized, smart, and resourceful. With these three elements, a graduating engineer could learn anything.

Studies involved a lot of a hands-on approach, with numerous trips to factories, and institutes, where students could see the knowledge they learn applied in the real world, helping them visualize what they have been taught. Dr. Ayoub claims that these trips helped students never lose memory of what they had been taught, with him remembering things he learned about 50 years ago, without having ever made use of that knowledge.

Upon graduation, jobs were plentiful, and few felt the need to look outside the country in order to seek employment. Dr. Ayoub, upon graduation, worked in environmental engineering, while he had studied architectural engineering. This was due to the strong base he possessed, which enabled him to learn other disciplines on the job.

During their stay at AUB, engineering students used to throw what used to be called the 'engineering show', which was the most popular show on campus. The former would feature all kinds of costumes, since women were not allowed at that time, with easy-going, sarcastic awards, such as Ms. AUB and Mr. AUB, being distributed at the end. The students were very fond of the show, as well as the two balls that they used to throw per year. The balls were always heavily attended due to the extremely social nature of engineering students.

There used to be numerous sports events, much more than these days, with games played against other professional entities, and even the USA's marines would be invited to participate in a game.



The students had a really good relationship with the faculty, and their professors. The latter used to know each of their students, and both parties used to enjoy that closeness. Dr. Ayoub states that the absence of such a relationship between students and professors in these modern times is a huge loss. He feels that this relationship helped students grow and achieve their potential more effectively. This helped pupils, who although used to work very hard, always find the motivation and time to be involved in other activities. A clear example of that statement is that every person enrolled in the faculty had to do a 20-minute exam every Saturday on all the courses he was taking. Once done with them, Dean Weidner would force his students to go the Green Field to practice sports. The graduation ceremony was also a more intimate affair than today, with students remembering it fondly.

Dr. Ayoub feels that students in the 50's were more involved in the AUB social life than students of today, and that helped them immensely in the future.

FEA, at its inception, was rigorous school of engineering, with an emphasis on a strong engineering base. It was one of the leading institutes in the Middle-East, and employers knew that. Graduating students always found jobs, even if they were completely unrelated to their field of study. Nonetheless, it was also a social and sports hub in Beirut and the Lebanon, where students got engaged in numerous extracurricular activities. Students had a closer relationship with the university, and remember it more fondly ■

An Aerosol Story

Dimitri Saad

Situated in the Irani Oxy Engineering Complex (IOEC) on the third floor is a laboratory hidden opposite to the main labs and offices which many in the faculty have never heard of. Towards the back end of the long hallway centered in that floor, lies the Aerosol Research lab.

To understand the function of the lab, it is necessary to start by defining an aerosol, which is typically a microscopic particle suspended in a fluid. Although we may not be conscious of it, the roots of many daily physical phenomena can be traced back to aerosols.

The subject of aerosol pollutants is among the main research interests of Dean Alan

Shihadeh, the head of the lab. The lab's claim to fame came in the early 2000s, through Dean Shihadeh's study on the effects of water pipe (shisha/arguile).

Although some found the topic of study to be absurd at the time, it nevertheless garnered the attention of international health organizations. The arguile initiative evolved as the lab tackled numerous other projects, notably those relating to engine exhaust emissions and the electronic cigarette (ECIG).

When the FDA put USD 18 million of funding towards a unified project about ECIG emissions, the local team at AUB became a part of an international team

known as the Center for the Study of Tobacco Products (CSTP), which also includes scientists and researchers from Virginia Commonwealth University (VCU), John Hopkins University (JHU), University of Arkansas for Medical Sciences (UAMS), University of Southern California (USC), NORC at the University of Chicago, the Ohio State University, and East Carolina University (ECU). The team from AUB mainly deals with toxicity testing, while the ones in VCU and JHU deal with the psychology and the market analysis relating to this cigarette alternative.

When this alliance was formed back in 2013, the ECIG, otherwise known as a vape, was growing in popularity,

**THEIR WORLDWIDE
CONTRIBUTION IS
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CAN CHALLENGE THE
TOP INTERNATIONAL
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PIONEERS OF RESEARCH.**

but there were little or no adequate regulations on the ECIG, due to its unknown effects on the human body. The popular belief regarding the health effects of ECIGs are that it is less toxic than the regular combustible cigarette. However, that may not be exactly the case, as researchers continue to study the issue.

The first project was

an overwhelming success, generating 111 publications over the span of 6 years, all of which contributed towards increasing comprehension on the dynamics of the ECIG. So in 2018, the CSTP was granted funding of \$20m, marking the second phase of studies.

To name a few, the current team of researchers consists

of the Dean, Ms. Rola Salman, Dr. Soha Talih, Mr. Nareg Karaoghlanian, Mr. Mohamad Baassiri, Mr. Ebrahim Karam, Ms. Zainab Balhas, some of whom are known faculty instructors.

The engineering team designs models and conducts experiments to validate the models. AUB's engineering and chemistry teams at the Aerosol Lab continue to study ECIG emissions

as part of a global and comprehensive team. Today, the lab is an active pillar in the scientific aerosol research community. Their worldwide contribution is exemplary in showing how AUB can challenge the top international universities as pioneers of research ■

Interview with Dr. Issam Lakkis

Khodr M. Jaber



Why did you decide to become a mechanical engineer? Were you majoring (or planning to major) in another field?

I was fascinated with airplanes when I was young, so the plan was to become an aeronautical engineer. Since that specialization was not available in Lebanon, I went into mechanical engineering.

How did you feel about the content of the undergraduate courses at AUB?

When I was a student there were more core courses required. Courses in fluids were more spread out, with individual courses focusing specifically on compressible flows, intermediate and advanced fluid mechanics at the undergraduate level. Now the requirements are different, and a few of these courses have been combined, while others became technical electives. This is more in line with US universities.

Are you happy with the way the curriculum is organized now?

Yes, after all AUB is a liberal arts university so we have to make space for the liberal arts courses. This is not the only reason actually: nowadays it's not enough to be a solid researcher. The demands of the job require other skills: communication, presentations, connections, becoming aggressive to get resources.

Did your experience in your undergraduate studies affect the way you currently give your courses?

No, they were largely affected by the way I took courses at MIT. I was very influenced by the mentality and philosophy of teaching (especially in the thermal/fluids sciences area).

Do you feel like you should have? Would it have made a difference?

That's a difficult question, I've never thought about it in this way. Probably not: in my days, getting to attend AUB was a privilege (it was not a given).

I think that students are currently under a lot of pressure to take part in extracurricular activities, we have plenty of engineering societies and clubs now. What do you think about this?

Now it is like this, yes, in my days we did not have that kind of pressure; if 'classical' researchers were to simply focus on their work rather than get involved in these things they wouldn't survive now. It's a completely different game. Even in the US, by the way, if you don't show on your resume as a high school graduate that you've been involved in lots of activities, tough luck: you won't get far.

Do you have any advice for current undergraduate students?

Yes, students should keep a balance between the different aspects of undergraduate life as this is the key to success. Don't focus on one thing. It's very tough nowadays, it was easier before.

What courses are you currently offering?

For undergraduate studies, I offer thermodynamics (MECH 310) in the Fall and fluid mechanics (MECH 314) in the Spring. For graduate studies, I usually offer micro flows (MECH 607), advanced fluid mechanics (MECH 760) and MEMS [microelectromechanical systems] (MECH 631). I once offered statistical mechanics, but I do not plan to do it again.

Why did you stop offering statistical mechanics?

For several reasons: one of them is that it is already offered in the physics department. Another one is that the graduate courses that I currently teach are always in demand. For example, I give advanced fluid mechanics every year. If I were to stop offering it, some people wouldn't be happy as graduate students rely on it for further thermal/fluid studies.

Did you see yourself becoming a professor when you were still a student?

No, after I went to the job market I discovered that research is what I wanted to do.

Ah, so you decided to go into research only after graduation (not while you were still a student)?

Yes.

What is your current field of research?

That's a tough one. Let's say different applications in fluid mechanics: species transport, flows spanning from the microscale (MEMS) to the planetary scale (such as ocean modeling).

What motivated you to go into this domain?

Regarding microflows: after I graduated I went to work for a couple of years in the field of microdevices, so I picked that up and I liked it. In terms of environmental (or flows related to environment): at some point in the past Dean (then-associate-professor) Alan Shihadeh suggested that I invest in that field. But the main reason is at some point I had to decide what field I wanted to use my knowledge in. In the beginning I stuck to theory without much focus on applications, but at some point, I asked myself the question of how I could use this theory in real-life problems. Atmospheric flows, oceanic flows and pollution transport in these environments was a natural choice.

Did you have (or still have) 'role models' for your research?

Yes, many: at different times, I had different research interests so the person (or people) guiding me would always be changing.

Do you think this is the case for researchers in general?

I think it's not a matter of choice anymore but rather a matter of survival. One cannot get stuck in their field of research for the rest of their career: they must always evolve. My advisor at MIT once told me that one must reinvent themselves every 10 years, and I kept this in mind. He says this to all his students and most of them abide by it.

What do you consider to be your major accomplishments?

I think my major accomplishment is what I was able to get through to my students ■

I THINK MY MAJOR ACCOMPLISHMENT IS WHAT I WAS ABLE TO GET THROUGH TO MY STUDENTS.

Dr. Sirine Taleb

Omar Badr

The annual International Conference of Arab Women in Computing held its 6th edition in Morocco between March 7–9. The conference celebrates women in computing in the Arab world and creates links for its participants with the global tech ecosystem. More than five hundred international and regional women and men from all technology sectors participated in making the conference the largest of its kind in the Arab World. The conference included fantastic and creative dissertations from Purdue University, USA and KAUST, KSA amongst other top institutions, vying for the various awards that were up for grabs.

In one of the standout moments of the night, AUB's own Dr. Taleb won the "Empowered Women for an Empowered Society" poster award for best PhD thesis at the conference with her poster presentation on display. Dr. Taleb's thesis is titled "Context-aware Dynamic Designs for Energy Efficient Mobile Sensing". The thesis discussed the proposal of a novel smart dynamic sensing framework for mobile phones designed for the collection of data from external and embedded sensors while trading resource consumption, application accuracy, and recognition delay.

Graduating from the accelerated PhD track in the Electrical and Computer Engineering department

at AUB in May of 2017; Dr. Taleb's interests are found in the fields of data science, technology and finance. As one of Maroun Semaan Faculty of Engineering and Architecture's top researchers, Dr. Taleb has focused her work on smartphone sensing, energy efficiency, adaptive and optimal sensing, mobile computing and context awareness. Dr. Taleb certainly holds a bright future in the field and has set herself apart at a very early stage of her career. The academic journey that has propelled her to such great heights was facilitated by the help and support of her supervisors Dr. Hazem Hajj and Dr. Zaher Dawy ■



SHE WON THE EMPOWERED WOMEN FOR AN EMPOWERED SOCIETY POSTER AWARD

AUB & Picon Rally Paper 2019

Jana Farhat

One of most exciting events to happen every spring semester is the AUB Rally Paper. Prepared yearly by the Student Representative Committee in the Maroun Semaan Faculty of Engineering and Architecture (MSFEA), the Rally Paper is a two-day event where teams of more than 100 people each partner with NGOs to win valuable prizes for a good cause.

This year, the AUB & Picon Rally Paper took place on April 6 and 7. Seven teams from inside and outside AUB gathered their members and divided their tasks to compete for the first, second and third prizes, which ranged from USD 3,000 to USD 10,000. The prizes were

offered by this year's generous sponsors: Picon, CFI, C U NXT SAT, Medco, Bank Audi and Lebanese Loto.

The full organization was done by AUB students who dedicated two full months to prepare the whole thing from planning to contacting sponsors, dealing with logistics and setting questions.

But winning was not easy at all, several physical, mental and unexpected challenges were to be completed during this enthusiastic weekend. The challengers in each team had to tour Lebanon from North to South to complete physical tasks and challenges: swimming

and skiing on the same day? The champs were on it! Treasurers, on the other hand, were ready to do anything to get what is asked: supermarket carts, signed newspapers, childhood toys as well as bottle cap to be recycled and clothes that were donated for people in need.

The teams' bases were full of members solving brain teasers, trivia questions and online challenges, they had to gather their programming skills, good memory and patience to solve some mind-blowing questions. Speaking of patience, this skill was much needed to solve the big quest revolving around an asteroid hitting the



country. Another fun part for the teams were the media challenges: song covers, video clips and picture and video parodies were the highlight for the talented stars and comedians. After the overwhelming weekend, results were announced on Monday

April 8th. The first-place winner was team Nartinolds composed of second year engineering students, the second-place winner was team Blitz who are third year engineering students, and third-place winners were non-AUBites: team Red Cross 204 ■

ONE OF MOST EXCITING EVENTS TO HAPPEN EVERY SPRING SEMESTER IS THE AUB RALLY PAPER

Build It Weekend: Bigger, Better & Stronger in its Third Edition

Aya Mouallem

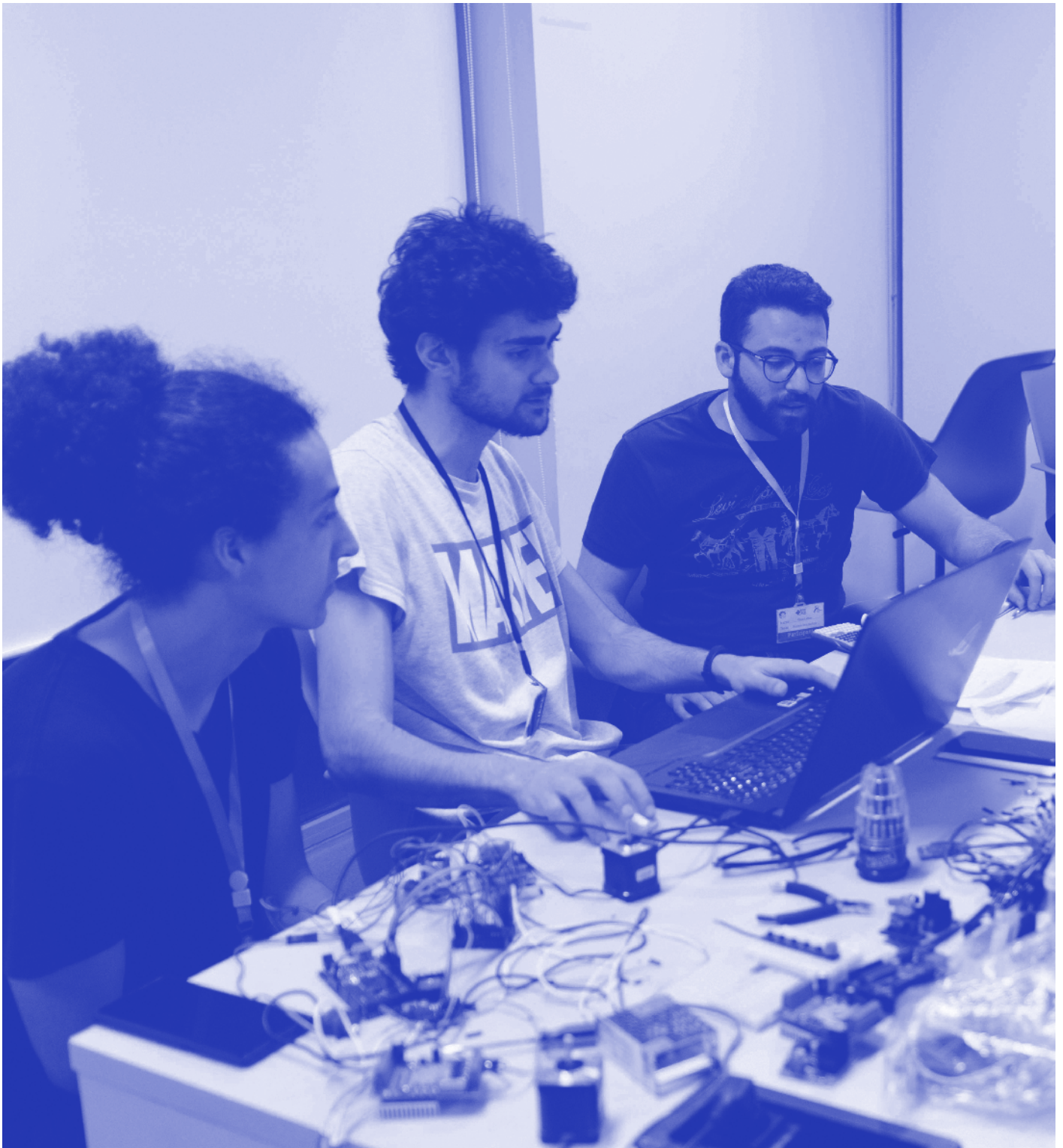
Build It Weekend 3.0, the national hardware hackathon annually organized by AUB's IEEE Branch and Robotics Club, took place this year at the Maroun Semaan Faculty of Engineering and Architecture (MSFEA) from February 8th to February 10th. The event gathered 140 hardware and tech enthusiasts from more than 10 universities and schools from all over Lebanon this year, reeling with excitement and ambition to build functional prototypes of ideas that can challenge the status quo and create direct impact in under 48 hours of sleepless hacking.

"Build It Weekend is a must-attend hackathon for anyone interested in building technology to advance humanity," says Larissa Abi Nakhle, the current president of the AUB IEEE Branch and a fourth year electrical and computer engineering student. She adds, "As hardware events are rare in Lebanon, we worked hard to keep

Build It Weekend free of charge and to ensure the success of the event. We collaborated with the AUB Robotics Club that ensured flawless execution of the technical aspects of the hackathon. Of course, we're very thankful for MSFEA's amazing support, and for the MSFEA professors who have joined us every year as exceptional judges."

In fact, Abi Nakhle's statements about the success and importance of the event are confirmed by the participants. Maher Kazzaz, a third year electrical and computer engineering student at AUB, describes Build It Weekend as "one of the few opportunities in Lebanon that provide students with resources such as 3D printers and excellent mentorship, so that they can bring their ideas to life." Some participants even decided to give back and volunteer in future editions. Ashraf Abi Said, a third year computer and communications engineering student





at AUB, serves as one example. “I participated in the 2.0 edition with my friends, and we ended up building a mini rover that can carry emergency supplies to survivors of war regions. I learned a lot in so little time,” Abi Said explains, adding, “This year, I decided to volunteer to help other participants learn as much. I enjoyed the event from a different

viewpoint, as I got to follow the development of several projects from scratch to fully functional prototypes, rather than focus on my project only.”

Build It Weekend has helped connect lots of tech enthusiasts and provide them with the hands-on experience that they may be missing out on in their theory-focused engineering courses.

Abi Nakhle states that the Build It Weekend experience continues beyond the hackathon. She explains, “We have a follow-up program where we track the further development of top projects, and we provide them with exposure and guidance so that they can participate in more competitions and hopefully scale their projects into startups.”

This year, Build It Weekend 3.0 resulted in top-notch projects with special focus on social impact. One MSFEA team built a smart Braille plotting machine with a voice command app that can translate English to Braille. Another MSFEA team built a dyslexia-tailored piano with light commands and automated instructor guide lessons. Both of these projects

secured prizes among the top five contenders. These projects are a small sample of what Build It Weekend resulted in, and they strongly prove that youth, and especially MSFEA students, can achieve significant impact when the right resources and support are available ■

Stefano Fallaha

Jana Farhat

Stefano Fallaha is a 20-year-old student in the Maroun Semaan Faculty of Engineering and Architecture (MSFEA). A successful entrepreneur who founded his own company Fallound Inc. He was recently listed in Forbes 30 under 30. Stefano is one of the top student entrepreneurs in the world and a TEDx speaker.

Can you tell us a bit about Fallound?

Fallound is a software for cars and app that connects to car navigation systems and finds for drivers perfectly-timed audio content according to their commute time and their interests. The app aims to fill in lost time while driving, walking or working out, with educational, entertaining and personalized content.

How was Fallound initiated? How did it you get the idea and was it easy to start it?

Fallound started as a side-project in the last year of school and has been evolving ever since. It started as a social network for audio. Multiple pivots and several product launches led us to find our product market-fit for commuters. I had no funding to start with, so I had to convince passionate people to join for the vision instead of the money. Fast forward 2 years, we raised funding from the Qatar Government's Supreme Committee for Delivery & Legacy in partnership with the 2022 FIFA World Cup.

What is next for you and for Fallound?

We're currently growing at 8% week-over-week, expanding our user base and forming distribution partnerships with telecoms and mobility services. We're also partnering with content creators and publishers to increase the content available in the region since podcasting is a hot market at the moment ■



**WE RAISED FUNDING FROM
THE QATAR GOVERNMENT'S
SUPREME COMMITTEE FOR
DELIVERY & LEGACY IN
PARTNERSHIP WITH THE
2022 FIFA WORLD CUP.**



IDEAS 2019

Paolo Junior Mrad

A BEAUTIFULLY WOVEN TALE OF SCIENTIFIC AMBITION CULMINATING INTO THE GRATIFICATION OF HUMAN INGENUITY IN ENGINEERING DESIGNS AND MODERN THOUGHT.

Have you ever pondered on the use of organic waste as a means of generating biodiesel on an industrial and municipal scale simultaneously? Have you ever wondered what characteristics of algae would presuppose that said biological organism could become an unconventional, yet plausibly highly effective anti-lung cancer drug?

Enter IDEAS 2019: a beautifully-woven tale of scientific ambition and aspirations, culminating into the gratification of human ingenuity in engineering new designs and the pinnacle of modern thought.

Throughout the event, which took place on the 17th and 18th of April 2019, students and professors alike were invited to take part in an eclectic array of conferences which stimulated its participants to introduce their ideas, prospects and endeavors

to the world. From the diversity of the theses, which were tackled in the three-minute talk conference, to the creativity of the startups that were presented at the designated demonstration module, this event strove to showcase the potential of engineering, architecture and graphic design prospects in pioneering mold-breaking concepts in today's society.

As a student's academic adventure unfolds, ideas are bound to be instigated within his conscience, attempting to break free. In light of that regard, IDEAS 2019, with the variety of categories it presents, aims to further enhance the development of one's rational perception of reality by virtue of nurturing one's sense of wonder and willingness to initiate progress within all his surroundings.

This two-day long inauguration of human resourcefulness

consisted of thirteen, well-established modules in tandem with an accompanying workshop on elucidating the mysteries of extensive learning and the yearly, extremely anticipated AUB big game.

The first day of IDEAS 2019 comprised mainly of two main subcategories:

- The celebration of notable graduate achievements in the fields of engineering and architecture.
- The discussion of a distinctive collection of undergraduate prospects throughout different medium of exposition, such as PowerPoint presentations and posters.

While the first set of modules was certainly compelling as it underscored the outstanding works of renowned alumni across the world, let alone the Middle East, similar events are commonplace in archetypal academic conventions. Conversely, the latter set of modules intrinsically stroked more interest and passion in the hearts of undergraduate students, ergo the

more predominant IDEAS 2019 attending party. As a matter of fact, the poster and FYP presentations rose up in popularity as they provided most of its participants with their first hands-on experience in their discovery of large-scale engineering features, while emancipating their desires to interact with top-caliber individuals within the domain they're striving to become part of.

For instance, the contenders in the aforementioned segments of the event were able to receive feedback on their designs and concepts as a means of further refining their work for future uses and / or expositions from noteworthy professors and researchers, while simultaneously showcasing their ideas to prospective and potentially interested parties. Henceforth, IDEAS 2019 lends itself to become a true venue of opportunities to satisfy the ambitions of assiduous individuals, quenching their thirst for knowledge and self-improvement.

The second day,

however, compromised prominently of the demonstration of post-graduate endeavors, notably in the form of short presentations which took place in front of audiences with varying background on the discussed subject matters. Thus, the inherent challenge of these modules would reside in the ability of the presenter in disserting their ideas with great acuity, yet with enough simplicity to be accessible to the addressees of discrepant levels of familiarity on the discussed thematic.

Moreover, the Maker Faire feature, which took place on the 18th of April, fits the mold of one of the more gripping modules of IDEAS 2019, in retrospect to its recognition, and dare I say, eulogy of human inventiveness and artistry in patenting new designs to solve unresolved constraints, while adding a hint of fun to the process of innovation. From the development of a bicycle-powered blender to the modernization of rollercoasters through smaller-scale models, this module packed a punch in delivering

its audience with a satisfying finale to the IDEAS 2019 venue, while further stressing upon the unfettered creativity of the MSFEA department in superseding the previously established thresholds in the world of designing and conceptualization.

All in all, as someone who had taken part of IDEAS 2019, it became concrete that the event represents a momentous stepping stone in the career of any prospective engineer, architect or graphic designer. Indeed, the event succeeds at rekindling the spirit of the free thinker that each individual seeking to be a part of the aforementioned domains should be endowed with, while revitalizing the need to rethink previously established concepts, as improvement is always a plausible and demanded feature in modern society. As this inspiring and well-crafted event came to an end, this apotheosis of scientific cleverness shed some light on the supposedly infinite potential of the upcoming generation of scientists and creators, as the tellers of a better tale and the harvesters of a more bountiful future ■



STUDIES HAVE SHOWN THAT **21%**
OF FATAL ACCIDENTS ARE
CAUSED BY **A DROWSY DRIVER.**



Alarmate

Ramy Rouss

Have you ever driven back home after a long day, and felt yourself slowly fading into your dreams behind the wheel?

You might not be aware of the consequences of drowsy driving, however the numbers are there: According to AAA foundation, studies have shown that 21% of fatal accidents are caused by a drowsy driver. As a matter of fact, drowsy driving and sleep deprivation have the same effects on the driver as being under the influence. And while it is legally possible to eradicate drunk driving, there is no legal means to pull over a driver who is falling asleep, which is why we took it upon ourselves as a team of 3 'Electrical and Computer Engineering' and 'Computer and Communications Engineering' students at the Maroun Semaan Faculty of Engineering and Architecture (MSFEA) at AUB to

tackle this matter as part of our final year project (FYP).

The team consists of Marilynn Berberi, Nadine Raad, and myself, Ramy Rouss. Our advisor is the wonderful Dr. Lama Hamandi who has been providing us with constant support and advice since day one. We also took part in the FYP accelerator program organized by MSFEA, and Mrs. Mona Itani as well as Mr. Elias Boustani, to whom we specifically want extend our sincerest gratitude.

The program helped us realize that we can develop our final year project into a startup enabling us, simultaneously, to own our business, and reach more people, leading to a big societal impact as a result. The program is designed in such a way to help us first realize what a startup really is by allowing entrepreneurs to share their journey

and experience with the students. Once we embarked upon the FYP accelerator program, we found out that the program covers all aspects of what is needed for our startups to be up and running: from customer analysis to design thinking and business modelling. Furthermore, it also teaches us how to pitch and more importantly gives us the chance to sell our projects to a jury for a chance to win up to \$30000, funds to invest in turning our project into a startup. On a more technical note, the device – named Alarmate – operates based on a hybrid technology that combines image processing and heart rate detection using a camera placed on the dashboard and a heart rate sensor embedded in the driver's seat belt. The image processing algorithm uses machine learning on a Raspberry Pi 3 to detect the eyes of the driver and

calculates the eye aspect ratio (ratio of longitudinal and latitudinal diagonals of the eye) to check whenever it becomes below 0.25 (which means eyes are almost fully closed) for 2.5 seconds or more (which signifies drowsiness and danger) and alerts the driver via an alarm sound. On the other hand, the heart rate detection studies the low frequency (LF) vs the high frequency (HF) of the heart and whenever

ENTREPRENEURSHIP

the heart rate enters the region where the LF is less than 60% and the HF is more than 40%, it means the driver is getting drowsy and after a few seconds into that region, the device will also sound an alarm to alert them. We tested the device in a car while driving and it yielded satisfactory results and response times. After two semesters' work and the accelerator's experience, we feel confident enough to move forward with our project and reach new heights. From a

technical side, we intend to use a NVIDIA Jetson X2 module and GPU programming which is more advanced than the Raspberry Pi we have been using. We also plan on using a much more advanced heart rate sensor to allow for a more accurate and reliable performance once we have a budget that allows us to. Furthermore, a couple of incubators approached us at IDEAS 2019, which was organized by MSFEA, to adopt our project and help us financially

to launch it. Finally, a special gratitude and acknowledgement to the MSFEA faculty and ECE department for supporting entrepreneurship initiatives taken by students and equipping them with the necessary tools to develop abstract projects into a reality.

We express our sincerest gratitudes to Dr. Lama Hamandi who truly stood by us through the hard times encountered in this project ■



Tree-D

Yahya Khaled El Ali

Lebanon, a country distinguished by its unique ecological formation and its charming natural wealth, and fauna and flora, has been facing exponentially growing environmental problems because of global warming – a catastrophic phenomenon which has accelerated harmful parasites' penetration of trees. Each year, harmful parasites infect thousands of trees, which explains the declining trend of the Lebanese Agricultural sector, which makes up an important part of the national GDP. The frequency of this occurrence rings the bell of social concern, as families lose a potential source of income.

Today, farmers in Choueifat – a Lebanese city – believe that the more trees are planted, the more tangible poverty is. This claim is valid. The

decrease in annual yields and harvest rates accompanied with increases in the costs of pesticide treatments implies a financial challenge and a setback.

Parasites are known to relocate from one tree to another which proves the necessity of treating all infected trees

However, many farmers, private owners, etc. cannot afford deploying the existing pesticide treatments on all the trees they own or can save which explains the ineffectiveness of the existing solutions.

By now, you are probably asking yourselves: "How big of an issue is this in monetary terms?" Entomologists estimate that, each year, Lebanon loses a value worth of \$1 Million because of 150 dead pine trees. With pine trees constituting 18% of the total trees in Lebanon, it is truly

EACH YEAR, HARMFUL PARASITES INFECT THOUSANDS OF TREES IN LEBANON

a devastating loss. Therefore, is developing a radical, autonomous and cost-effective product feasible? The answer is Tree-D. Tree-D is a service startup that utilizes drones, chemical pellets, and a shooting mechanism to deliver autonomous, highly accurate, and cost-effective seasonal treatments for trees. Tree-D is made accessible to every single person for an affordable price starting from LBP 5,000 per tree. What are you waiting for? Make every cent count to save the Lebanese environment ■





EyeMate: Giving You an Extra Eye

Simon Tchaghlassian

Joseph, Georges, and I were out on our typical coffee break at Starbucks Ain Al Mraiseh, standing in line waiting for the barista to take our order when an idea sprang up. "What if the barista memorizes the typical orders of every regular customer?"

Will that eliminate queue times?", Joseph asked me. "But how can he memorize the orders of over a thousand customers?", I replied. Then we started to think, "Why are there long queue lines to begin with?"

We concluded the following assessment. Orders are usually customized, easily adding up to 20 to 40 seconds to the total time of the ordering process, depending on the complexity of the customization. Thus, taking an average time of 30 seconds per customization, the average wait you have to undergo if 8 people ahead of you customized orders, is four minutes. That is the origin behind EyeMate. EyeMate

EYEMATE IS A PLATFORM THAT SIMPLIFIES THE ORDERING PROCESS

is a platform that simplifies the whole ordering process, by anticipating the orders of a customer. It uses a camera with face recognition to recognize a customer that has already been at the fast-food chain, and digs up his previous orders, predicting what this person is most likely going to order this time around using artificial intelligence.

The team consists of Joseph Maroun, Georges Bassil, and myself, Simon Tchaghlassian. We are all Computer and Electrical Engineers from the Maroun Semaan

Faculty of Engineering and Architecture (MSFEA), with different business backgrounds under our belt. After having come up with the idea, we decided to test its real world validity by entering the first startup competition that came to mind, the Darwazah Student Innovation Contest, which is organized and sponsored by Samih Darwazah Center for Innovation Management and Entrepreneurship of the Olayan School of Business.

This startup accelerator aided us at developing the idea, coming up with a viable business

plan, further studying the addressable market size, and devising an effective go-to-market strategy. What EyeMate does is simple; it remembers your face. Similar to a server memorizing the preferences of his/her usual clients, EyeMate links the preferences of the customers with the features of their face. EyeMate can be placed on the counter or at a self-ordering kiosk POS (point-of-sale), scan the customer's face using the latest technology of computer vision and will automatically bring up the customer's most ordered combination of food and beverage at the appropriate

time of day and at that fast food chain. If the customer wants to try something new and has no idea what to request, EyeMate will use machine learning algorithms to come up with a new combination the customer is most probably going to delight in. We aim at reducing the time needed for a customer to voice his order by an average of five minutes, greatly increasing the profits of the fast-food chain utilizing our product.

After winning the Darwazah Student Innovation Contest and conducting successful interviews and surveys,

we are now well on our way to finalizing our first prototype, implementing it, and then launching it. We are looking to partner up with several coffee shops at first for product testings.

To illustrate, we will be installing our beta version at 10 coffee shops in Beirut, for a period of one year. During that time, we will be altering our product and fixing bugs and glitches and optimizing it. We hope that our startup takes off with flying colors and that it starts bringing coffee to the hands of people in the most efficient way possible! ■

PCMT: Using Drones and Software in the Construction Industry

Mahe Kazzaz

In its second edition, the FYP accelerator program has helped final year students transform their FYP ideas into viable businesses. Among the teams are four civil engineering students who worked on solving the issue of delayed projects and resource mismanagement in the construction industry.

According to Reuters, the global market value of the construction industry is expected to rise from \$10.6 trillion in 2017 up to \$12.7 trillion in 2022. Despite being one of the highest valued markets globally, many companies in this industry fail to meet their project deadlines due to resource mismanagement and inaccurate scheduling. This is where the team stepped in to provide construction companies with a practical solution that helps them allocate their resources efficiently and mitigate the risk of having delayed projects. Saad-Chris Cheiban, John Karam, Marie Naccache and Joey Nseir are a group of Civil Engineering students who participated in the FYP Accelerator Program at AUB and founded a startup called PCMT to tackle this issue. According to Saad, "the startup provides construction companies with an application that is capable of determining the number of days a project is expected to be

delayed. The application then determines the number of workers that should be working on each activity in the project in order to avoid such delays." This application is connected to several location chips mounted on the hats of the construction site workers. These location chips monitor the number of workers working on each activity in the project. A project manager then logs into the application and provides information about the project such as the deadline, the estimated productivity of the workers and the working conditions. Given this information, an algorithm then provides the project manager with the number of workers needed on each activity in order to meet the project's deadline. This optimal distribution of workers is compared with the current worker distribution to calculate the number of days the project is expected to be delayed.

The team decided to take their project a step further and increase the accuracy of their application's estimates. John mentioned that "since our application takes as an input the productivity of workers which may differ from one project to another, we decided to use drones to calculate the productivity for our client's specific project."



THE FYP ACCELERATOR PROGRAM HAS HELPED FINAL YEAR STUDENTS TRANSFORM THEIR FYP IDEAS INTO VIABLE BUSINESSES.

Through providing visual data and monitoring the change in the shape of the construction site, drones calculate work progress in a given amount of time and deduce the productivity of workers specific to this project. Having a better accuracy of the worker productivity results in an increase in the overall accuracy in the application's estimates. Saad added that, "a study we conducted showed us that the information provided by our application allows construction companies to improve scheduling

by 17% and decrease costs by 2%. In an industry where every day of delay is very costly, the savings we provide are very valuable."

While reflecting on the whole experience, the team mentioned that, "we are really proud of what we accomplished. Around 60% of construction companies worldwide need tools that can help them manage their projects better and we successfully provided that." The team also added that they still have big plans for their startup and their project. "We

are currently working on a functionality that allows the application to redistribute workers among the activities. For example, if activity 1 is expected to be delayed while activity 2 will be complete ahead of time, the application will be capable of suggesting to move 'x' workers from activity 2 to activity 1." ■

Fatima Makkeh

Data is the most expensive currency in our modern times, and it is reshaping our world. That is why everyone is trying to collect and analyze data. The Arab world has a very vibrant social media culture, however, when it comes to Arabic dialects, the available social media listening tools are very limited. A group of three computer and communication engineers: Ahmad El Moussaoui, Hiba Ghalayini and Fatima Makkeh decided to fill the existing gap between the resources and the needs, leading to the creation of Aquila.

Aquila is a social media-monitoring tool that collects and analyzes tweets in Arabic dialects using natural language processing. This was our final year project. For two semesters we were blessed to have the help and support of our advisor, Dr. Fadi Zaraket, who accompanied us step by step during this journey. We used twitter application programming interface (API) to collect tweets in Arabic dialects, before using our computational model to clean, process and analyze the data.

We have created Arabic models covering four dialects. The Yemeni, Iraqi, Saudi and Bahraini dialects were implemented in our software. It was important for us that the interface be very simple, that's why using Aquila is straight forward;

you have a topic that you wish to know what people think about, you write your keyword and Aquila will search the internet traffic for relevant information, analyze it and give you what you need to know. We believed that Aquila has the potential of becoming a successful business. However, at its inception, we didn't know where to start nor what to do. That is why we applied to the Final Year Project Accelerator Program. We were lucky to be one of the teams selected by the judges to join the program where we got hands on experience in market study, business modeling and client approach. We also learned how to pitch our idea, what really interests investors and what they wish to hear.

By the end of the first semester we made it through the second round of interviews, which enabled us to carry on in the accelerator program during the spring semester.

We attended workshops on marketing, finance, law and many other aspects of the business life. We met mentors, incubators and successful people. Slowly, we acquired the needed knowledge to launch our own startup. Today, we are ready to face the world. Our first step will be to participate in the accelerator's competition in order to try and win a

AQUILA IS A SOCIAL MEDIA-MONITORING TOOL THAT COLLECTS AND ANALYZES TWEETS IN ARABIC DIALECTS USING NATURAL LANGUAGE PROCESSING.



\$30000 prize that will help us start our own company. Following the competition, we will be working on enhancing our product, covering more dialects and approaching clients knowing that we already have some video game companies that interested in our product and are waiting for the final result. Aquila made Arabic data easily accessible because Aquila is the future of market study "Bel 3arabi" ■

TODAY, WE ARE READY TO FACE THE WORLD.



AS STUDENTS, WE
OFTEN ADMIRE
THE IDEA OF
BEING **GIVEN**
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ORIENT OUR OWN
PASSIONS.

As students, we often admire the idea of being given the freedom to innovate, create, and orient our own passions. I believe that the Final Year Accelerator program was an initiative that intended to respond to that longing so many of us have.

At first, the idea of independence alluded, in our expectations, to a path of success, useful connections, and individual growth. However, the journey has introduced us to the realistic and practical constraints of becoming an entrepreneur. The story of Achghali

through the accelerator program started with the motivation to help ourselves and the AUB community. We wanted a platform that was designated for us to find a part time job that matches our set of skills and expertise. We also wanted a platform where we could find individuals capable of helping us do our own tasks in a more efficient and effective way.

We figured that so many individuals are looking to make an extra income to diversify their wealth resources. We figured that a lot of individuals have to juggle between

numerous tasks that they have to carry through on a daily basis.

We decided to develop Achghali, the platform that would allow people looking to earn a bit of money to connect to employers and fulfill a task requested, satisfying both sides. Workers would end up making use of their time and employers would get their task done, while saving money in the process.

Our team finally launched Achghali. This milestone could not have been done without the guided orientation of the

accelerator program. Through the former, we had the opportunity to understand the practical business aspects of a technological idea.

We were taught how to mold the code we wrote, while keeping in mind the experience of the end user. Through the FYP accelerator program, we learned a lot about our capabilities, our limitations, and highlighted the parts of our professional personalities that we need to nurture and develop further.

Achghali is the offspring of a fully dedicated and passionate year of work. Our hopes for the future is for it to grow to become the vision we carry deeply in our hearts ■



“Word from faculty member”

ShowTime for “Cogs & Caffeine”

I am thrilled to hear about the establishing of a student-led communication hub at MSFEA. Such news comes like a breath of fresh air along with a new student-led magazine “Cogs and Caffeine”, which promises to deliver student news, thoughts, vision and innovations. Having been a member of a student led magazine during my undergraduate years, this news brought back many memories that rushed to my head. I remember the campus just after the distribution of each edition, where students would gather in groups holding in their hands the printed papers and discussing the various articles that defined the students' lives on campus and impacted their social compass across the country. The magazine spoke our language as students and reflected our spirit back then.

“Cogs and Caffeine” release is timely, it will certainly constitute an outlet for MSFEA students to express their inner reflections and radiate it into the open like an electromagnetic wave propagating in free space. It is a venue where the students share their experiences and discuss their success stories and MSFEA highlights. It encompasses MSFEA students that are the current that powers this faculty. I can't but emphasize the importance of such an outlet, simply by reminiscing on what this meant to me as a student and what it meant to my professors who approached me to discuss every article I wrote. For me as a professor at MSFEA I look forward to the numerous editions of this magazine and to the intrigue that this magazine will induce in all faculty members. I cannot but express my excitement for this initiative that will inform me as a faculty member on the creative and further innovative sides of MSFEA students.

Break a leg “Cogs and Caffeine,” It is ShowTime!

Dr. Joseph Costantine is an associate professor in the electrical and computer engineering department at MSFEA. His research interests are in applied electromagnetics, Antennas and RF circuits for IoT devices, RF systems for biomedical applications and RF energy harvesting. Dr. Costantine has several publications. In 2019, Dr. Costantine gave a well-attended talk at IDEAS 2019 titled “How to charge your phone from thin air”. Dr. Costantine also received many awards throughout his career including the 2019 AUB teaching excellence award ■

GRAPHIC DESIGN CLASS OF 2020

COMMUNICATION DESIGN, PUBLICATION DESIGN,
PACKAGING AND ENVIRONMENTAL DESIGN

Aaaa Fletel



Reina Hasbini



Aaaa Fletel



Aya Khalifeh, Rana Tawil, Fatema Taher,
Sarah Najem.



Michelle Hamed, Dalida Raad, Saheer
Ghazzawi, Wadli Haddad.



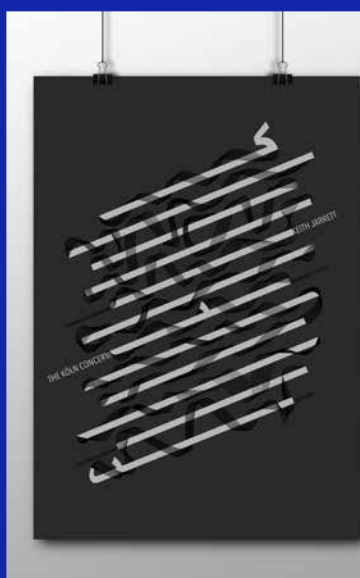
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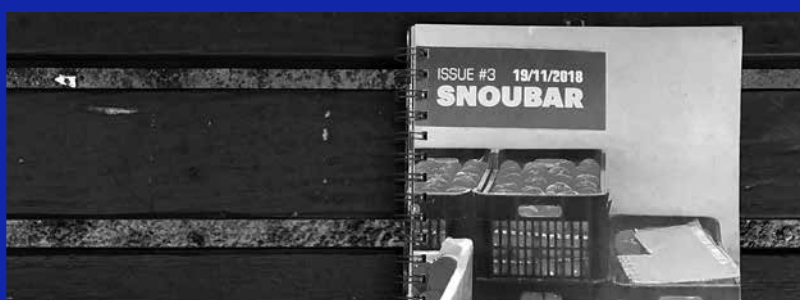
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