World Robot Olympiad - Uganda 2023 Report

VENUE: MAKERERE UNIVERSITY, COLLEGE OF ENGINEERING DESIGN ART & TECHNOLOGY (CEDAT)

DURATION: 3rd to 10th November 2023



REPORTED BY: **SOLOMON BWIRE** SIGN.....DATE: 21st /11/2023

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To:
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Dear Dr. Cathy Mbidde,

REF: **REPORT ON WORLD ROBOT OLYMPIAD ACTIVITIES (3RD TO 10TH NOVEMBER 2023)**

I hope this letter finds you in good health. I am writing to provide you with a detailed report on the activities that unfolded during the World Robot Olympiad (WRO) in Uganda, particularly the launch event that took place on November 3, 2023.

The WRO activities were a resounding success, engaging schools, educators, and students in an exciting journey of learning and innovation. The launch event, held at Makerere University on November 3rd, marked the beginning of a series of impactful initiatives aimed at promoting STEM education and inspiring the next generation of innovators.

The launch event was a spectacle of youthful creativity and enthusiasm. Your presence as our chief guest added immense value and prestige to the occasion. The insightful remarks and encouragement you provided resonated well with the participants and set a positive tone for the entire WRO program. On behalf of the organizing committee and Makerere Innovation Society, I extend my heartfelt gratitude for your invaluable contribution to the success of the launch event. Your willingness to spare time from your busy schedule to grace the occasion and share your wisdom with the young minds greatly contributed to the event's significance.

The momentum generated by the launch event has laid a solid foundation for future initiatives. We are eager to continue collaborating with Makerere University Innovation Hub under your esteemed guidance. The WRO activities have not only instilled a passion for robotics and artificial intelligence in the students but have also opened doors for potential collaborations and educational advancements.

I have attached a comprehensive report detailing the various activities that took place during the WRO, including school visits, training programs, and the National Championship and Hackathon. I believe this report will provide a thorough insight into the impact and success of the program.

Once again, thank you for your unwavering support and commitment to fostering innovation and education in Uganda. We look forward to the possibility of future collaborations and initiatives.

Yours sincerely,



Solomon Bwire
Chairperson, Makerere Innovation Society

Enclosed: Comprehensive report about WRO – Uganda

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Introduction

The World Robot Olympiad (WRO) in Uganda marked a significant milestone in fostering STEM education, innovation, and collaboration among young minds. The WRO, a global initiative aimed at fostering creativity and technological proficiency among youth, unfolded as a week-long series of events. It encompassed a grand launch event, enlightening school visits, and culminated in a National Championship and Hackathon at Makerere University - CEDAT. This report serves to encapsulate the essence of these activities, providing insights into the impact on students, challenges faced, and the overall success of the event.

As we delve into the details, you will witness the fervor and commitment of students, educators, and partners who contributed to the success of the WRO. Their dedication resonates with Makerere University's commitment to advancing education, innovation, and community engagement.

About Makerere Innovation Society

Makerere Innovation Society (MIS) is a youth-led network of passionate innovators at Makerere University with the aim of supporting the capacity of young people to become opportunity creators. Makerere Innovation Society founded in 2018 at Makerere University - CEDAT has a driving mission to create the future of millions of students in East Africa through training, inspiring, and empowering them with innovation, leadership, entrepreneurship, and employable skills required for them to thrive as job creators influencing the economic affairs of their communities. At the heart of MIS lies a vision to cultivate a generation of innovators capable of influencing their communities positively. This is realized through a mission that emphasizes equipping members with cutting-edge skills and knowledge acquired from Makerere University, empowering them to develop innovative solutions to societal challenges.

About Creative Child Foundation

Creative Child Foundation is a non-profit organization dedicated to empowering children in underserved communities through innovative STEM education, entrepreneurship, and creative coding. With a mission to foster creativity, critical thinking, and problem-solving skills, we strive to provide equitable learning opportunities and bridge the digital divide for children in Uganda.

The foundation is an initiative of **Makerere Innovation Society** to empower children with lifelong learning opportunities required to thrive in this 21st century workforce as opportunity creators not just seekers. To achieve her mission, Creative Child Foundation launches Innovation / Co-creation hubs and clubs in primary, and secondary schools with a mission to provide a creative and safe after-school science and technology innovation learning environment where learners aged between 6 and 18 work with adult mentors to explore their own ideas, develop new skills, and build confidence in themselves through the use of technology during allocated time for co-curricular time. In support of that mission, Makerere Innovation Society supports school-based Co-creation hubs around East Africa by providing start-up support, professional development, new technology innovations, evaluation and assessment, partnership opportunities, and access to an online community for children, mentors, and STEM innovation teachers.

About WRO

The World Robot Olympiad (WRO) stands as a global platform that ignites the spark of creativity, innovation, and technological prowess in young minds. Founded in 2004, WRO has evolved into an international phenomenon, engaging students across the world in the exciting realms of robotics and artificial intelligence (AI). The World Robot Olympiad competition uses Lego Mindstorms manufactured by LEGO Education. First held in 2004 in Singapore, it now attracts more than 28,000 teams from more than 85 countries.

WRO's primary mission is to inspire and develop young minds into future innovators and problem solvers. By fostering a love for science, technology, engineering, and mathematics (STEM), WRO aims to cultivate critical thinking, teamwork, and practical skills in participants, preparing them for the challenges of the digital age. WRO competitions are designed to be inclusive, catering to various age groups and skill levels. Participants range from as young as six to eighteen years old, showcasing a spectrum of talent and enthusiasm. The competition structure includes categories such as Regular Category, Open Category, and WRO GEN II Football, each presenting unique challenges. WRO is not just a competition; it is a vibrant community of learners, educators, and enthusiasts. Through collaboration with schools, universities, and various organizations, WRO creates an ecosystem that nurtures talent and promotes the exchange of ideas.

This year's launch set the pace for 2024 where we plan to engage over 100 schools and send winners to finals which will be held in Turkey.

Activities

1) Launch of World Robot Olympiad

   The launch, held at Makerere University, College of Engineering Design Art & Technology was a grand affair, attracting educators, innovators, and enthusiastic young minds. The opening ceremony featured inspiring speeches from key figures, including our chief guest Dr. Cathy Mbidde, Director of the Makerere University Innovations Hub. The atmosphere was electric as Maya Amarri Mbabazi, the young and confident MC, set the tone for the engaging discussions and activities that followed.

   Dr Cathy lauded young ambitious talents for taking the courage to not only participate in the competition but also embark on the journey of positively influencing the affairs of their communities and addressing challenges around them.



Figure 1:Dr Cathy, our esteemed chief guest encouraging youngest participants at the competition

The panel discussion held during the World Robot Olympiad was a captivating exploration into the minds of our budding innovators, aged between 7 and 13 years. Led by the eloquent 9-year-old Maya Amarri Mbabazi, the discussion delved into the profound impact of robotics and artificial intelligence on the future of work. The young panelists, each a beacon of intelligence and enthusiasm, articulated their perspectives on how these emerging technologies could revolutionize industries and communities. These inspiring leaders were selected from Peak Primary School -Ntinda, Makerere College School, Kharis International School, Barack Community School, Our Lady of Africa SS, MST Junior School, and The Stoneridge School.

Maya Amarri Mbabazi, with her natural flair for leadership, skillfully guided the discussion through thematic areas such as healthcare, agriculture, transport, and education. The young minds on the panel shared insightful thoughts on how robots could be harnessed to solve real-world problems, from assisting in medical procedures to automating agricultural tasks for food security.

The moderator's prompt questions drove the conversation deeper, challenging the panelists to consider the ethical implications of AI and the responsibility that comes with innovation. The responses from these young innovators were nothing short of remarkable, showcasing not only their technical knowledge but also a profound understanding of the societal impact of their creations.



Figure 2: Panelists getting set to share their knowledge.

The panel discussion was not just an intellectual exchange; it was a glimpse into the future where these bright minds are not just users of technology but its architects. The event left an indelible mark, emphasizing the potential of nurturing young talent in STEM fields and inspiring others to follow suit. It was a testament to the World Robot Olympiad's commitment not only to competition but, more importantly, to the holistic development and empowerment of the innovators of tomorrow.

2) School Visits

The World Robot Olympiad 2023 embarked on a transformative journey with school visits, aiming to empower young minds in Robotics and Artificial Intelligence. This activity involved impactful sessions conducted at various schools, including Peak Primary School, Makerere College School, Our Lady of Africa SS Namilyango & Mukono campuses, Merryland High School Kigungu, MST Junior School, Kings Norton International School, Kharis Schools, Barack Community School-Nansana, The Stoneridge School, and Crane High School.

The school visits (3 days per school) had a multi-faceted agenda, focusing on equipping learners with essential skills, fostering innovation, and preparing them for the National Championship and Hackathon.

The objectives included:

- ✓ Imparting Design Thinking Skills.
- ✓ Developing Robotics using Arduino.
- ✓ Enhancing Simulation Skills with Tinkercad.
- ✓ Instilling Artificial Intelligence Knowledge.
- ✓ Polishing Pitching and Presentation Skills.
- ✓ Cultivating Computer Programming Skills.

Statistics and Figures

Number of Schools Visited: 11
Total Participants: Approximately 500 learners
Age Group: 8 to 18 years
Sessions Conducted: Workshops, hands-on activities, and interactive discussions.

The school visits were a resounding success, providing learners with a platform to explore, innovate, and envision a future intertwined with technology. The statistics and figures reflect the extensive reach and impact of the World Robot Olympiad's mission to empower the next generation of innovators and problem solvers. The engagement and enthusiasm witnessed during these visits lay a solid foundation for the upcoming National Championship and Hackathon.

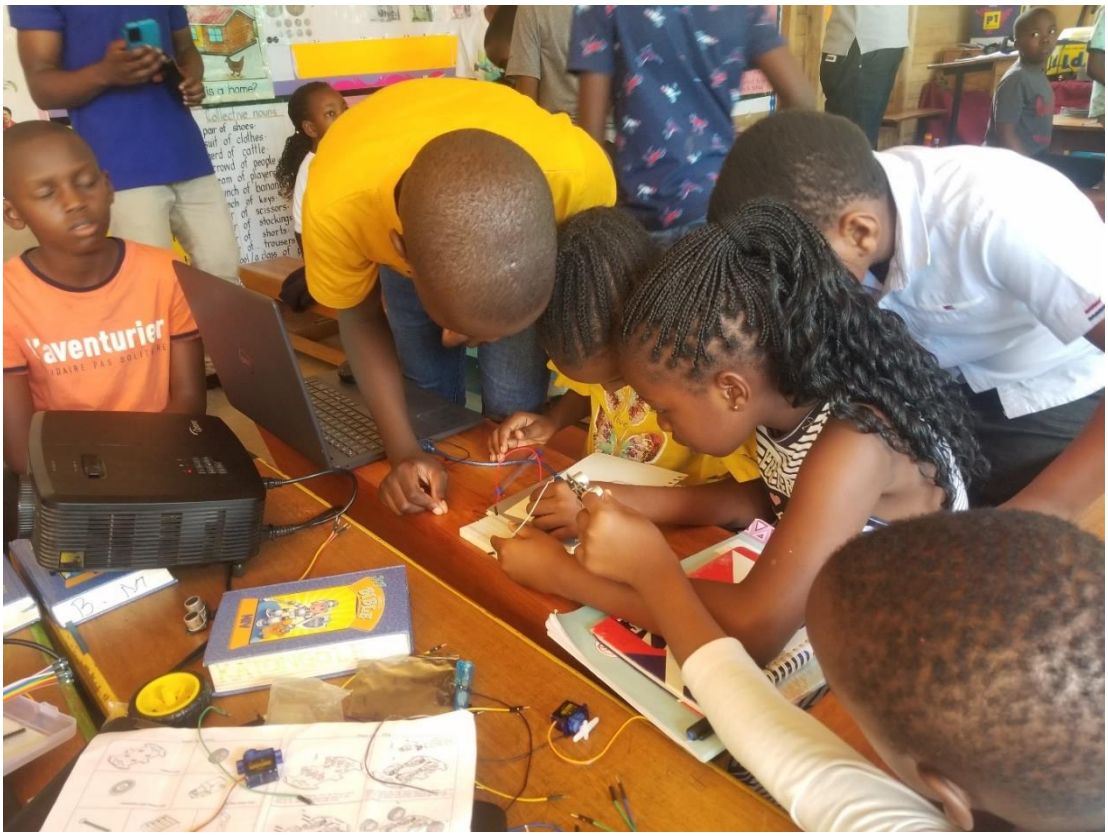


Figure 3: Determined, focused and passionate learners engaged in electronics/robotics design & programming

Tinkercad, a powerful online tool for 3D design and prototyping, played a pivotal role in the training sessions. The impact of introducing children to Tinkercad was profound and multifaceted, aligning with the broader purpose of nurturing creativity, problem-solving, and innovation.

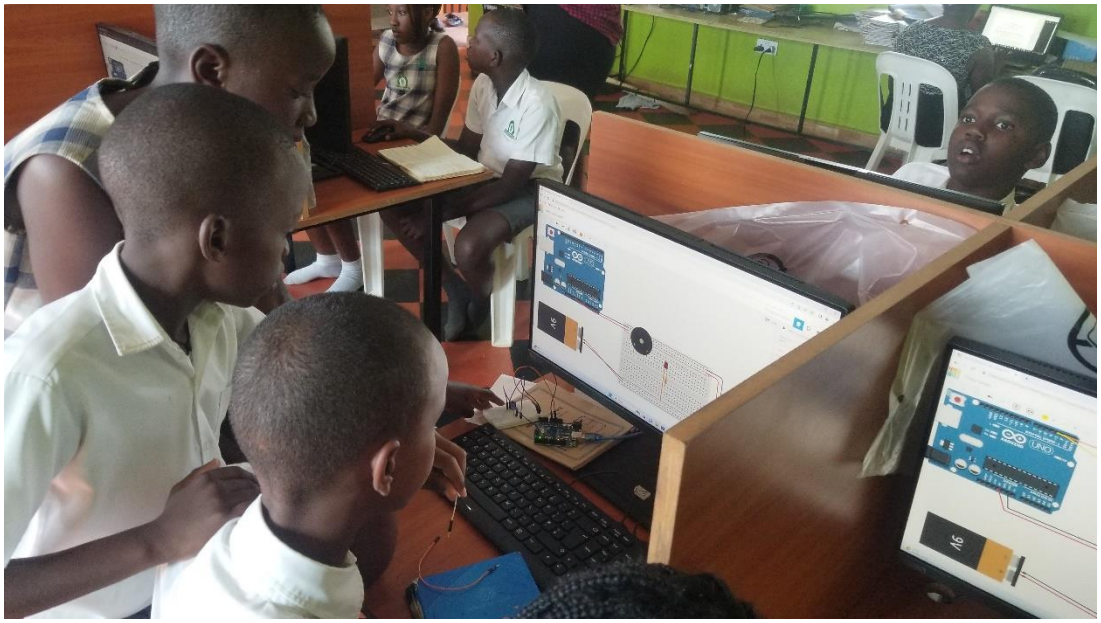


Figure 4: Learners at MST Junior School freely interacting with Tinkercad for the first time

Tinkercad facilitated a hands-on learning experience that allowed children to visualize and create in a virtual space. Through intuitive drag-and-drop features, children could design and manipulate 3D objects, providing a tangible and interactive aspect to their learning. The platform's user-friendly interface encouraged children to unleash their creativity. From designing basic shapes to creating intricate structures, Tinkercad empowered learners to turn their imaginative ideas into tangible prototypes. This process sparked innovation and original thinking. It served as an excellent introduction to the concept of prototyping. Children could not only design digital models but also understand how these models could translate into physical prototypes. This hands-on experience laid the foundation for practical problem-solving. In addition, Tinkercad provided a practical context for applying STEM (Science, Technology, Engineering, and Mathematics) concepts. Children learned geometry, spatial relations, and basic engineering principles in a dynamic and engaging manner, making STEM subjects more accessible and enjoyable.



Figure 5: Learners being introduced to simulation of Robotics systems

The collaborative features of Tinkercad allowed children to work together on projects. This collaborative learning encouraged teamwork, communication, and the sharing of ideas. In a world increasingly reliant on collaborative problem-solving, these skills are essential.

Tinkercad's applications extend beyond the classroom, providing a glimpse into real-world design processes. By engaging with this tool, children gained insights into how professionals use similar platforms for product design, architecture, and engineering.



Figure 6: Makerere College School learners collaboratively involved in brainstorming activity

The training of children to build Arduino-based robotic projects during the World Robot Olympiad had a profound impact on their cognitive development and problem-solving skills. Arduino, with its open-source hardware and software, provided a versatile platform for these young minds to delve into the world of robotics. The purpose was two-fold: to nurture their creativity and to instill problem-solving capabilities.

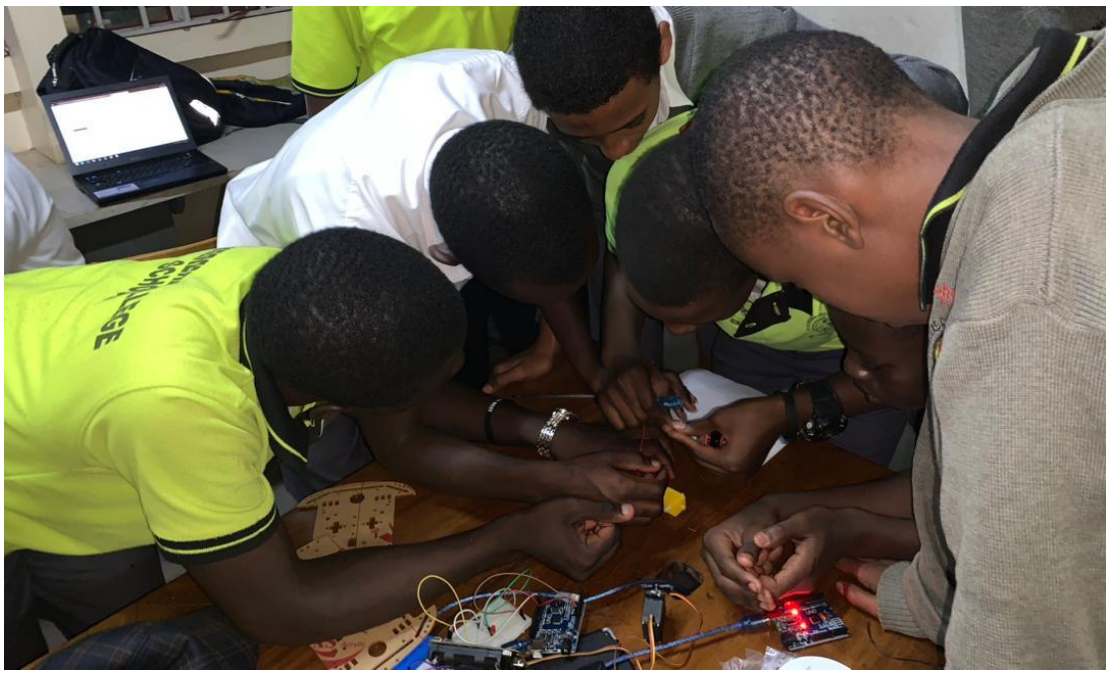


Figure 7:Learners experimenting with Arduino collaboratively.

The hands-on nature of Arduino projects allowed children to transcend theoretical knowledge and engage in practical applications. They learned to connect sensors, actuators, and other electronic components, transforming abstract concepts into tangible, functioning robots. This practical aspect not only made learning enjoyable but also provided a platform for experimenting with ideas. The purpose was not just to teach them about robotics but to encourage them to become creators and innovators.

Furthermore, the Arduino training aimed to develop problem-solving skills among the children. As they encountered challenges during the project-building process, they were required to analyze, troubleshoot, and iterate on their designs. This iterative problem-solving approach was intentional – it aimed to equip them with resilience and adaptability, vital skills in a rapidly evolving technological landscape. The purpose of introducing Arduino robotics was not merely to produce technically proficient individuals but to foster a mindset of curiosity, resilience, and innovation.

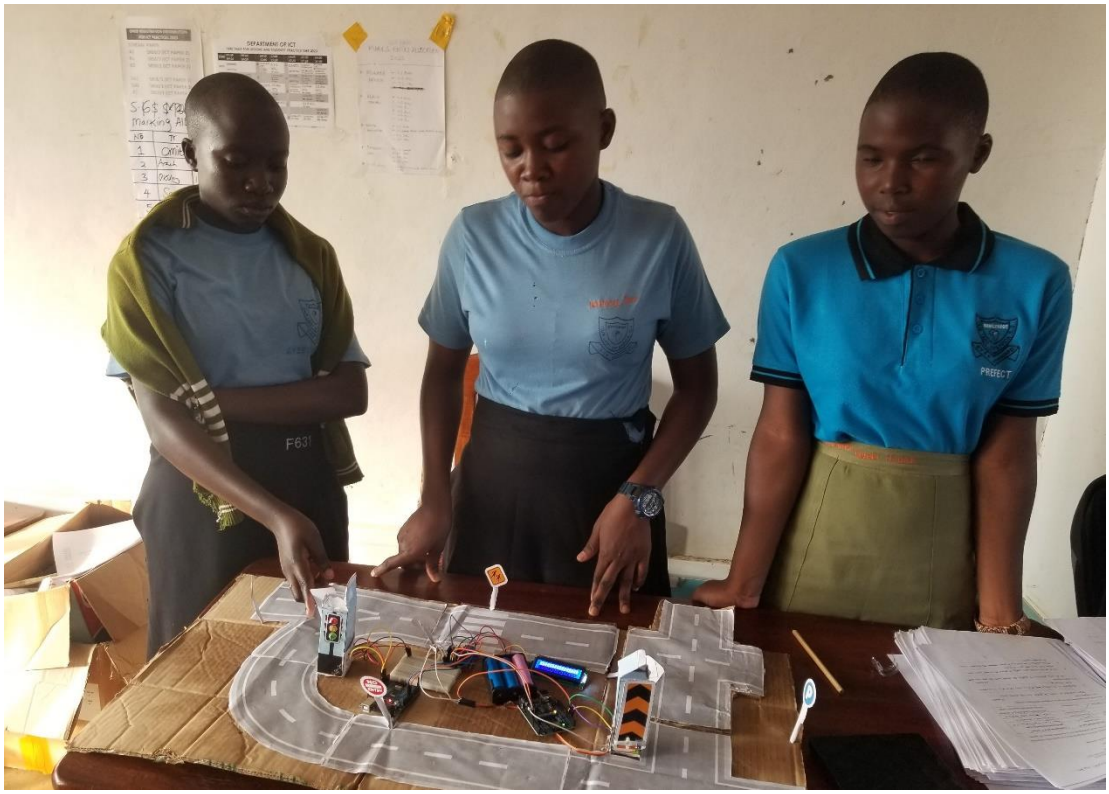


Figure 8:Learners demonstrating their project after a hands-on training workshop at school

In essence, the impact of Arduino-based robotic training extended beyond the realm of robotics itself. It became a catalyst for nurturing a generation of creative thinkers and problem solvers, ready to face the challenges of the future with confidence and ingenuity. The purpose was to lay the foundation for a mindset that views challenges as opportunities for innovation and leverages technology for positive change in the world.

The intentional focus on polishing pitching and presentation skills during the school visits as part of the World Robot Olympiad had a transformative impact on the participating learners. The purpose extended beyond the immediate goal of preparing them for the final hackathon; it aimed to cultivate a set of communication skills essential for success in various aspects of their lives. Through interactive workshops

and simulated pitch sessions, the learners were not only taught how to articulate their ideas effectively but were also given the opportunity to build confidence in expressing their thoughts.



Figure 9:Learners demonstrating skills acquired during pitching workshop

3) National Championship and Hackathon at Makerere University

The pinnacle of the WRO Uganda was the National Championship held at Makerere University on the 10th day of November 2023. Teams from various schools showcased their ingenuity, having honed their skills during the school visits.



Figure 10: Team of innovators from Peak Primary school collaborating during hackathon



Figure 11: First runners up(age 8 -12) pitching their solution to judges

The winners, Our Lady of Africa SS Namilyango (ages 13-18) and King Norton International School (ages 7-12), emerged from a competitive field, demonstrating exceptional problem-solving abilities.



Figure 12: Finalists awarded with medals

All participating groups received co-creation resources and robotic toolkits. These resources were instrumental in prototyping their solutions into working products. The

tangible outcomes showcased at the finals underscored the impact of providing students with the tools needed to turn their ideas into reality. All teams went back home with their prototypes and tools used at the hackathon to act as a steppingstone for the continuity of the program within their schools and at home.

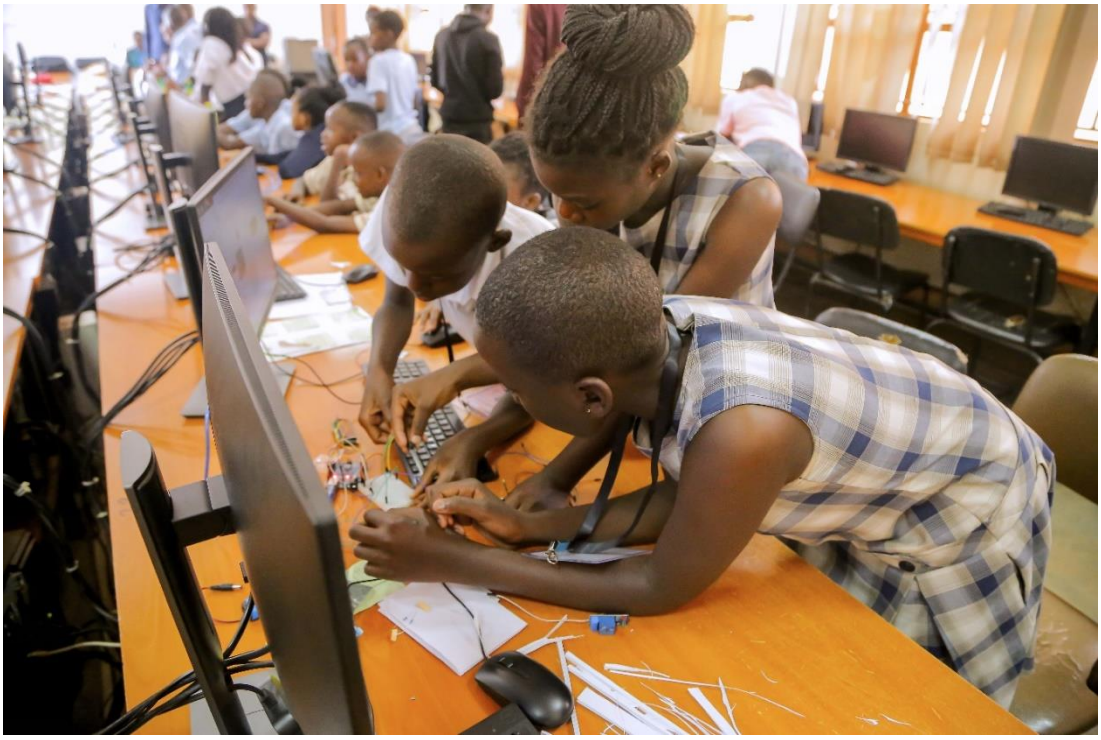


Figure 13: Creativity happening during hackathon

General overview of results from the judges are as follows.

Rank	**School (8 -12-year-olds)**	**Score**
1	King Norton International School	86.5
2	Peak Primary School	82
3	MST Junior School	81
4	The Stoneridge School	78.5
5	Kharis Schools	71.5
6	Barack Community School-Nansana	60
Rank	**School (13 -18-year-olds)**	**Score**
1	Our Lady of Africa Namilyango	93
2	Makerere College School - Main	91.5
3	Makerere College School - Mulawa	84
4	Our Lady of Africa SS Mukono	81
5	Crane High School	77

We believe that all participants put in incredible efforts and developed good working prototypes in a span of only three (3) hours. This event was not about winning, it was about learning and preparing for more challenges ahead and we encourage schools to continue engaging children in such events and competitions to keep them sharp.

The main comment from judges was that most of the teams were not prepared enough to give sufficient responses to questions from judges and didn't know much about why

they were developing their innovations something which may have greatly affected their scores.



One notable challenge during the finals was time management. Delays in the submission of project ideas and toolkit requirements by some finalists extended the event duration. This issue will be addressed in future editions through improved communication channels and early coordination.

Recommendations for schools

i. Integration of STEM in Curriculum.
Encourage the integration of STEM (Science, Technology, Engineering, and Mathematics) activities into the regular curriculum. This could involve incorporating robotics and AI-related projects as practical applications of theoretical concepts.

ii. Establishment of a Robotics Club or Innovation hub.
Initiate and support the formation of a robotics club within the school. Makerere Innovation Society (Creative Child Foundation) with its comprehensive STEM curriculum, resources and toolkits for young innovators can support with the establishment and sustaining activities. This would provide a dedicated space for interested students to delve deeper into robotics, fostering a spirit of innovation and teamwork.

iii. Continuous Professional Development for Teachers.
Facilitate continuous training and professional development programs for teachers to ensure they are well-equipped to guide students in their robotics and AI endeavors.

Workshops and training sessions conducted quarterly at Makerere University can enhance their understanding and competence in these areas.

iv. Participation in Future Competitions.
Encourage the school to actively participate in future robotics competitions, not just as a means of competition but as an opportunity for students to showcase their skills and innovations on a broader platform.

v. Creation of an Innovation Corner.
Designate a dedicated space within the school premises as an 'Innovation Corner.' This could be a place where students can work on projects, display their innovations, and engage in creative thinking.

vi. Parental Involvement.
Foster parental involvement by organizing events or sessions where parents can witness and appreciate the innovative projects undertaken by their children. This can strengthen the school-parent partnership. It could be school innovation exhibitions, science fairs or just during class days students demonstrate their STEM projects.

vii. Regular Monitoring and Evaluation.
Establish a system for the continuous monitoring and evaluation of STEM activities. This would help in assessing the impact of these initiatives and making necessary adjustments for improvement.

viii. Collaboration with External Organizations.
Explore partnerships with external organizations, including Makerere Innovation Society, to bring in additional resources, expertise, and opportunities for students and teachers.

ix. Emphasis on Real-World Problem-Solving.
Encourage projects that emphasize real-world problem-solving. This approach not only enhances the practical application of knowledge but also instills a sense of responsibility and purpose in the young innovators.

x. Recognition and Celebration of Achievements.
Regularly recognize and celebrate the achievements of students in STEM-related activities. This can include awards, certificates, or even simple acknowledgment ceremonies to boost the students' morale and enthusiasm.

Implementing these recommendations can contribute to creating a vibrant STEM culture within primary and secondary schools, nurturing the next generation of innovators and problem solvers.

Conclusion

The journey from the launch of the World Robot Olympiad in Uganda to the National Championship and Hackathon at Makerere University has been nothing short of inspiring.

Witnessing the enthusiasm, creativity, and determination of the young minds who participated in the various events reaffirms the profound impact of robotics and artificial intelligence education. The engagement with schools, the immersive training sessions, and the culminating hackathon not only imparted technical skills but also instilled in these learners a sense of innovation, critical thinking, and collaborative problem-solving. The commitment and dedication displayed by students, teachers, and partners throughout this initiative underscore the potential for STEM education to shape the future.

It marked a significant milestone in fostering STEM education and innovation among the youth. The school visits, training sessions, and the grand hackathon at Makerere University were a testament to the potential and eagerness of young minds to embrace robotics and artificial intelligence. The impact of these initiatives was evident not only in the innovative projects created by the students but also in the enthusiasm and passion they exhibited throughout the process. The dedication of teachers, the support of school administrators, and the collaboration with external partners added depth to the program, creating an ecosystem where learning was not just theoretical but practical and impactful. While the hackathon faced challenges, particularly with time management, it served as a valuable learning experience. It highlighted the need for better coordination and communication, lessons that will undoubtedly contribute to the refinement of future events.

As we reflect on the success of this endeavor, it's evident that the journey doesn't end here. We extend an invitation to educators, parents, and stakeholders to continue supporting initiatives that empower young minds with essential skills in robotics and AI. The enthusiasm and potential demonstrated by these learners highlight the need for sustained efforts in integrating STEM education into mainstream curricula. Furthermore, the collaboration with schools and partners has set the stage for ongoing programs that foster innovation, creativity, and a deeper understanding of technology's role in solving real-world challenges. Let's collectively embrace the responsibility of nurturing the next generation of scientists, engineers, and innovators, ensuring a future where every child has the opportunity to contribute meaningfully to the advancement of our society. As we look forward, the Makerere Innovation Society remains committed to advancing robotics and AI education. The report serves not just as a record of past accomplishments but as a roadmap for future endeavors. The experiences gained will inform our approach, ensuring that we continue to evolve and tailor our programs to meet the changing needs of young innovators.

In closing, we express gratitude to Makerere University, College of Engineering Design Art & Technology (CEDAT), Irish Aid through Embassy of Irelend in Uganda, Google, all the schools, teachers, students, and partners (Mindset Coders, Young Engineers) who contributed to the success of the World Robot Olympiad. Together, we are shaping a future where the spirit of innovation and the drive for excellence are instilled in the hearts and minds of the next generation. The journey continues, and we are excited about the boundless possibilities that lie ahead.