Designed and Built at Makerere University

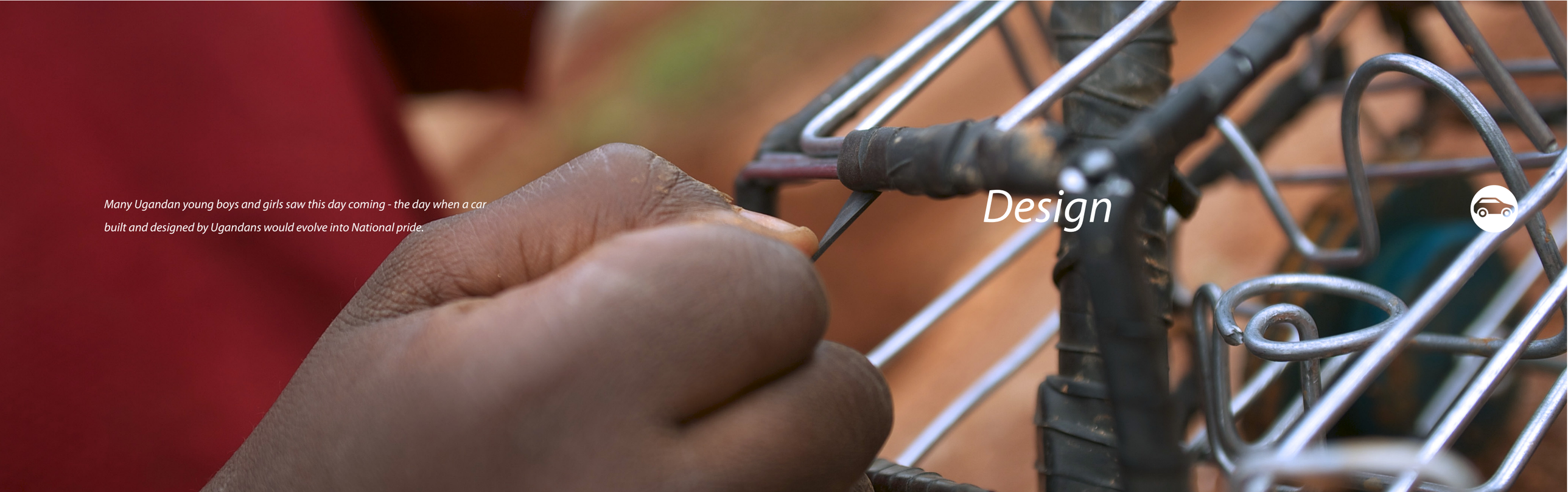
KIIRA EV

A Ugandan creation, in unison with nature

The new face of ***Africa's transport***

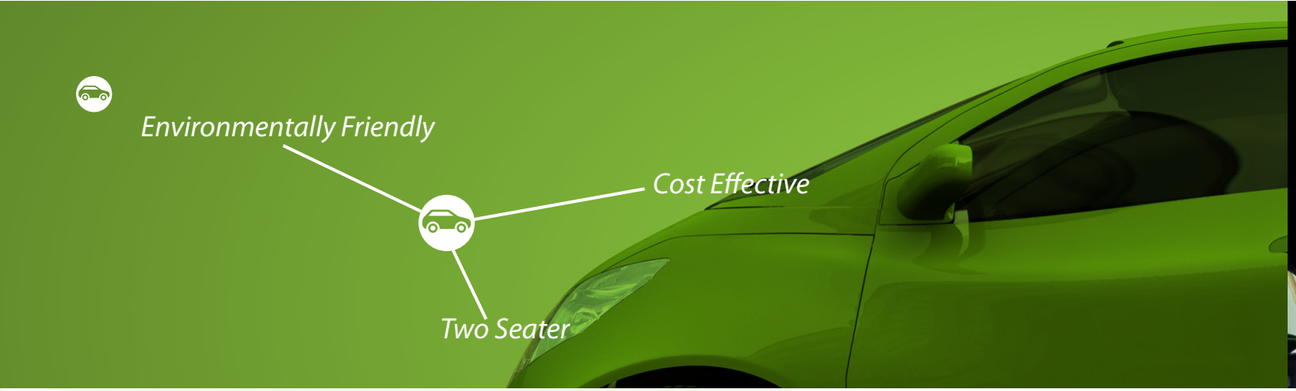
Thanks to the technology department at Uganda's largest university Makerere , the Kiira Electric Vehicle is a brain child of Africa. The gorgeous motor creation has been supported by Ugandan President Yoweri Museveni's initiative to support science and technology. The two-seater electric vehicle designed and built by Ugandans is here to redefine the way we move like never before.

Discover our journey inside.



Design

Many Ugandan young boys and girls saw this day coming - the day when a car built and designed by Ugandans would evolve into National pride.



In 2008, a Global consortium of top thinkers from the world's prominent research institutions, under the umbrella of the Vehicle Design Summit (VDS), came together to address the challenge of building energy efficient vehicles; the project code name was Vision 200 (www.vehicledesignsummit.org). Makerere University was the only team from an African university. A centre for research in transportation technologies was conceived. A Vehicle Design Project was commissioned.

Beyond Vision 200, VDS, aimed at inspiring young people everywhere around the world with big ideas and lack resources to act independently and seek expertise and resources they need to forge solutions to a wide range of diffuse challenges facing our planet today. Back at home, the Ugandan team set out to put to use the skills acquired through their involvement in this collabvoration to impact the Ugandan society in the field of Transportation. As a result the idea for setting up a center for research in transportation technologies was born

The Vehicle Design Project set out to design an automobile using alternative fuel (electricity) for the University Community. The Kiira EV 2 seater was to act as a Proof-of-Concept vehicle which had to address the challenges experienced with the use of traditional pollutant non-renewable transportation means that use fossil fuels.

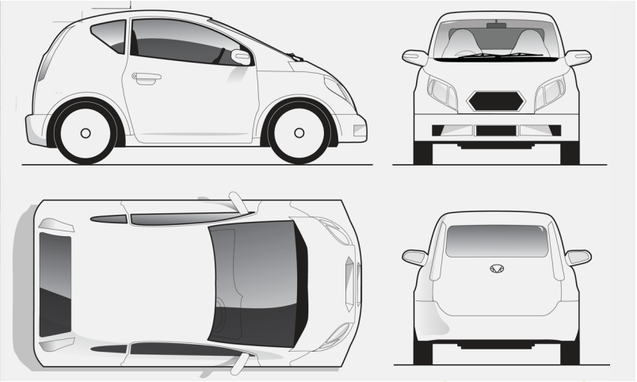
Presidential Initiative

On 12th December 2009, His Excellency the President of the Republic of Uganda, Gen. Yoweri Kaguta Museveni, visited the Faculty of Technology, Makerere University. During His visit, His Excellency was treated to a cocktail of Science and Technology Innovations in incubation at the august Faculty of Technology which to-date celebrates over 40 years of prestigious Instruction and Research. Notable amongst these were Research into Solar Technology, e-Governance Systems Development Project, Makapads Project, Technology Development and Transfer Centre, the Innovations Clusters Programme and the celebrated Vehicle Design Project.

Subsequently, H.E. invited staff and students of the faculty to a meeting in State House, Entebbe on 28th December 2009, attended by sector ministers.

In the meeting, H.E. expressed his delight at the great potential for Science and Technology Innovation exhibited by the Faculty of Technology and pledged to support the Faculty of Technology to the tune of UGX 25 Billion for the period 2010/2014.

Design Specifications



Number of Doors	3
Seating Capacity	2
Length	3000mm
Width	1600mm
Height	1500mm
Engine	Front wheel drive electric Motor
Power	26 Horse Power
Body Type	Fiber-glass

Safety	Crumple Zone
Turning Radius	3866 mm
Steering	Electric Power Steering
Gearbox	One-speed gear ratio 11:1
Wheel Base	2175 mm
Dry weight	700 Kg
Top Speed	100 Km/hr
Range	80 Km

Many had the idea, the courage, the tools but never the push

Engineering

Many electric vehicles have been built since their invention in the early nineteen century though this technology is old, it has suffered serious setbacks due to the competition from internal combustion engines.

The KIIRA EV 2 uses a simple system consisting of an Energy storage bank, energy converter and a rotary machine (induction motor). Simply put, it is powered by electricity which is stored in the in the battery bank through repetitive charging.

The Energy Storage System

The battery system of the Kiira EV consists of Lithium-ion batteries with very high energy storage capabilities, high charge acceptance, high specific power and high energy density. The battery system banking is unique consisting of 4 battery banks of 64 cells connected in series. The banking ensures energy system modularity for effective battery monitoring, safety, increased reliability and maintenance. The battery bank capacity of 40 AH and 207 V is engineered to achieve an inter-charge distance 80 km, a requirement for a commuter student vehicle on Makerere University campus.

The battery is protected through an intelligent battery management system which monitors and controls individual cell temperatures for maximum cell safety. Each cell has sensor on Printed Circuit Board plate which monitors the individual cell temperatures, voltages and currents for effective power utilization from each individual cell. The battery energy restoration system (charging) is unique in implementation because battery charge restoration will be achieved from any wall socket at home which is readily available in the city center. This negates the need for new charging infrastructure.

The Drive System

Front wheel drive power transmission layout is adopted to achieve maximum torque transmission, minimize mechanical power losses and create ample space at the rear.

The Vehicle 'engine' consists of a controller and motor. An induction motor has been used because it is very efficient compared to other motor types and its rigidity and torque output performance likens it to the conventional internal combustion engine.

Motor control is achieved through an efficient Vector control algorithm for effective power switching from the inverter. The inverter utilizes intelligent power modules for three phase switching to the motor. Driver communication of commands to the motor controller is through a distributed communication network implemented using the CAN protocol

Intelligently Powerful,
packed with the latest standards

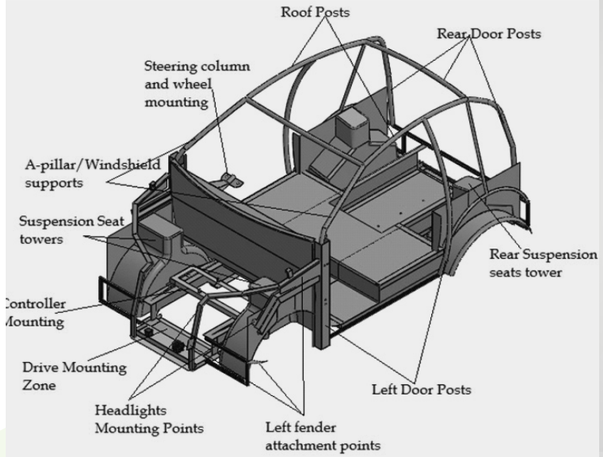
The Communication System

A real time control and communication network is incorporated to serve the control of the car environment and ensure the safety of the passengers. It provides real time information to the driver regarding the state of every Drive terrain subsystem. The onboard display system is designed to promote easy use. It provides guidelines for location of faults and recommends how the faults can be rectified. Another reason for you to nod at, is it's gracefulness.

Realtime control & communication across over 1000 components

Body & Frame

The KIIRA EV is designed to perform with maximum cabin space, best aerodynamics performance and aesthetics. The frame work of round cross-section tubes offer great resistance to impact. The passengers' protection is paramount.



An aesthetic beauty in and out

Years later, we are here. We've built and assembled an engineering masterpiece, tough yet beautifully African

Experience

Like a courageous African hunter boasting of a thick skin. KIIRA EV proves solid enough to persevere through the renowned African terrain. Though it is built with a solid exterior to persevere through the renowned African terrain, the Kiira EV's beauty and practicality top the list.

The Kiira EV body has been fabricated out of light weight fiber glass material through simple tooling techniques .It consists of a super-frame built around standard parts like the windscreen, doors, etc. using small bars (4mm) to form webs for strength purposes

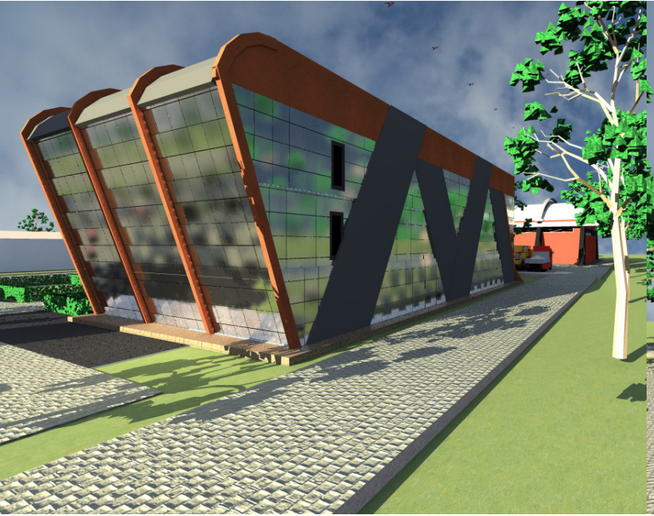
Before the final body finish, a wire mesh super frame was laid onto the web of small bars to narrow down the sinking space frames/ windows for glass fiber compound (Isopon P.40).

The hardened and smooth finish of the body is made out of a mixture of Isopon P.40 fiber glass compound and Dibenzoylperoxide compounds as a hardener which when dry is sanded to achieve the a final finish of light weight but strong body .

Comfort is seamlessly achieved with simplicity and purpose. Inviting as this, fully laid out in leathery and a comfy setting, only airlines can compete.

Driving forward

We believe our brightest innovations are ahead. Our dreams stretch further than our first attempt. We shall continue...



Envisioned Research Center

The strategic goal of the vehicle design project is to incubate a Centre for Research in transportation technologies with a vision of presenting a wholesome solution to the transportation needs in Uganda. In the follow up to the KIIRA EV we intend to design and build a 28-seater commuter electric vehicle as public transport means, code-named the "KAYOOLA"

In the long run we intend to attend to the most pressing issues in the public transport domain like urban traffic management and the rural transportation of agricultural produce.

28 mini-bus seater concept

Professor S.S Tickodri Togboa

Principal Investigator, Vehicle Design Project

The Vehicle Design Project (VDP) - a program envisaged to contribute to a new paradigm of training in our institutions of higher education and innovation, hereby unveils its proof of concept through KIIRA EV. VDP was conceived out of the experiences gained from our participation in the collaborative framework of 31 premier engineering universities of the world that designed and produced Vision 200 in Torino, Italy, during the northern summer of 2008.

Through KIIRA EV, VDP hereby delivers our undertaking, given in September 2009, that we had the capacity, capability and passion to produce our own electric car as a first step in the search for viable green solutions to our transportation challenges. With VDP, we believe we have demonstratively provided the kind of framework necessary to harness the inherent passion in the top cream of the youth from the secondary education system by enabling them to participate in the challenge to seek solutions to our contemporary development issues.KIIRA EV, as the output product, has been possible because of funds availed through the Presidential Support for Science and Innovations. To advance the product to higher and commercial levels will require continued financial support. We need a Center for Research in Transportation Technologies (CRT2) with Workshops, Assembly Line, Testing Tracks and Offices. We have already embarked on the design and production of a 28-seater electric and solar powered bus.

To this end, I therefore invite you to scan and read through this issue of the magazine and contact us with any ideas and support for the way forward. I appeal to Government Institutions and Organs, the Private Sector and Individuals. Come forward and buttress the Presidential Support for Science and Innovations and thereby enable us to train and properly orient the current generation of our youth to be the human resource required by the contemporary and future work world, powered by modern technology.

Dr. Barnabas Nawangwe

Principal College of Engineering, Design, Art and Technology, Makerere University

The dream of Uganda making a car has finally come true. Congratulations to the Vehicle Design Team!

This historic achievement by the group of young engineering students and their mentors is a major milestone in the struggle against Africa's marginalisation and the emancipation of her intellectual power. The car project is one of many innovative projects undertaken by CEDAT. The launch of the KIIRA EV car is testimony to the great potential that exists at Makerere University and CEDAT in particular, for innovations that will transform the socio-economic condition of our country and the region. That potential has been clearly demonstrated, and what remains now is for all stakeholders to make the necessary investments in research and innovation at CEDAT.

This historic achievement would not have been possible without the support of many stakeholders, particularly the support of H.E. The President of The Republic of Uganda, Yoweri Kaguta Museveni. His support for innovation has been a major boost to the aspirations of our young intellectuals, who are the future of our beloved Country. As we celebrate this remarkable milestone in our history, the main challenge remains the potential to turn the KIIRA EV into a commercial product with an affordable price. For this, we will definitely need the support and encouragement of all our stakeholders, especially the Government and the Private Sector. On our part, we will continue on the path of research and innovation towards total emancipation of our people.

As We Build For The Future!

Am glad to be a part of the a team with a history making vision - Jonathan K

Success of a project is defined by a group working together - Kaweesa Brian, Student Developer

"The KIIRA EV has been a promising endeavor, am proud to be associated with it" - Gerald Baguma, Graduate Research Assistant

The experience is more like getting to the finish line only to realize a worthy string of tighter races ahead - Muyanja Fahadi, Student Developer

"I believe in the value of our effort; I believe Africa will find a real solution in KIIRA" - Ndyabawe Kenneth, Graduate Research Assistant

"It is technically fulfilling when today's idea becomes tomorrows reality such as the KIIRA EV" - Richard Madanda, Graduate Research Assistant

"Good things come to those who stretch out to get them" - Mourice Wandera, Graduate Research Assistant

"This is just the genesis of realizing the potential resident within us" - Fred Matovu, Graduate Research Assistant

When a great adventure is offered, you do not refuse it, I can never consent to creep when I feel an impulse to soar - Nanyonga Margaret, Student Developer

"It has been an honor to work with a team of great minds and fulfilling to see the fruits of hard work" - Pauline Korukundo, Graduate Research Assistant

I am blessed to be a part of this innovation - Namazzi Rosette Lule, Student Developer

Working on the project has enabled me to live on the cutting edge of technology. An infinite loop of information, innovation and invention - Mugabi Edgar, Student Developer

By their fruit you will recognize them (Matthew 7:16) - Paul Isaac Musasizi, Technical Coordinator

The project has helped me realize my potential and also acknowledge that the sky is the limit for those who have faith, patience and willingness to go the extra mile - Africa Junior, Student Developer

It's been a transcendent experience. There's a lot more to learn by doing than by thinking indefinitely - Victor Tumwine, Student Developer

This project has been a wonderful experience for me and it's a starting point towards the country's advancement in the world of technology and innovation - Muhumuza Richard, Student Developer

This has been an experience far beyond my wildest dreams. Fingers crossed for what's yet to come - Magezi Arnold, Student Developer

Thanks to

HE the President of the Republic of Uganda, Gen. Yoweri Kaguta Museveni

Uganda Government

Dr. Barnabas Nawangwe

Makerere University

Gatsby Garage

National Instruments

Azure Dynamics

Al Hajji Habib Kagimu (Habib Investments)

ARMS Project

iLabs

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