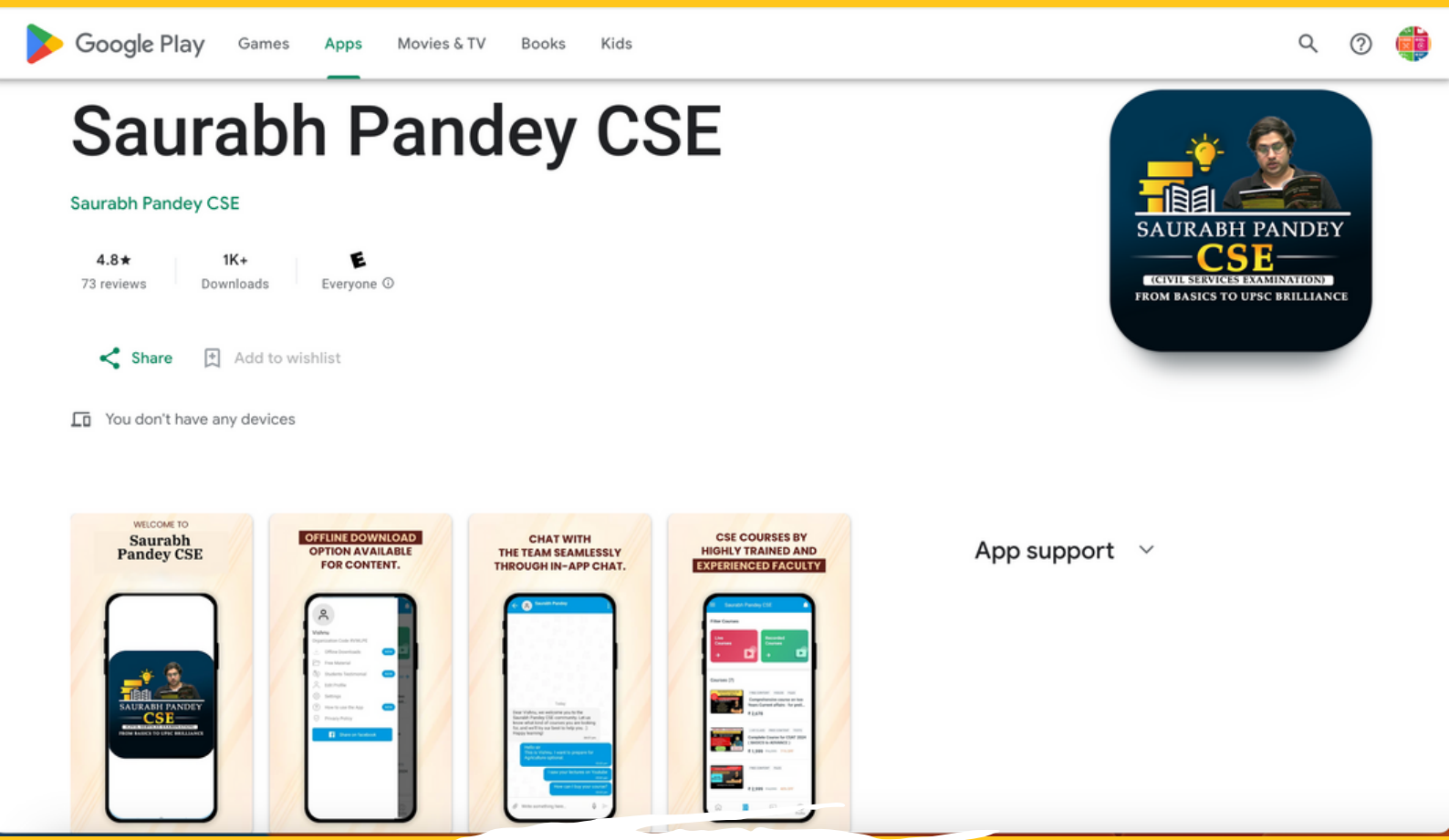
THE HINDU ANALYSIS

18th March 2024

by saurabh pandey

THE HINDU



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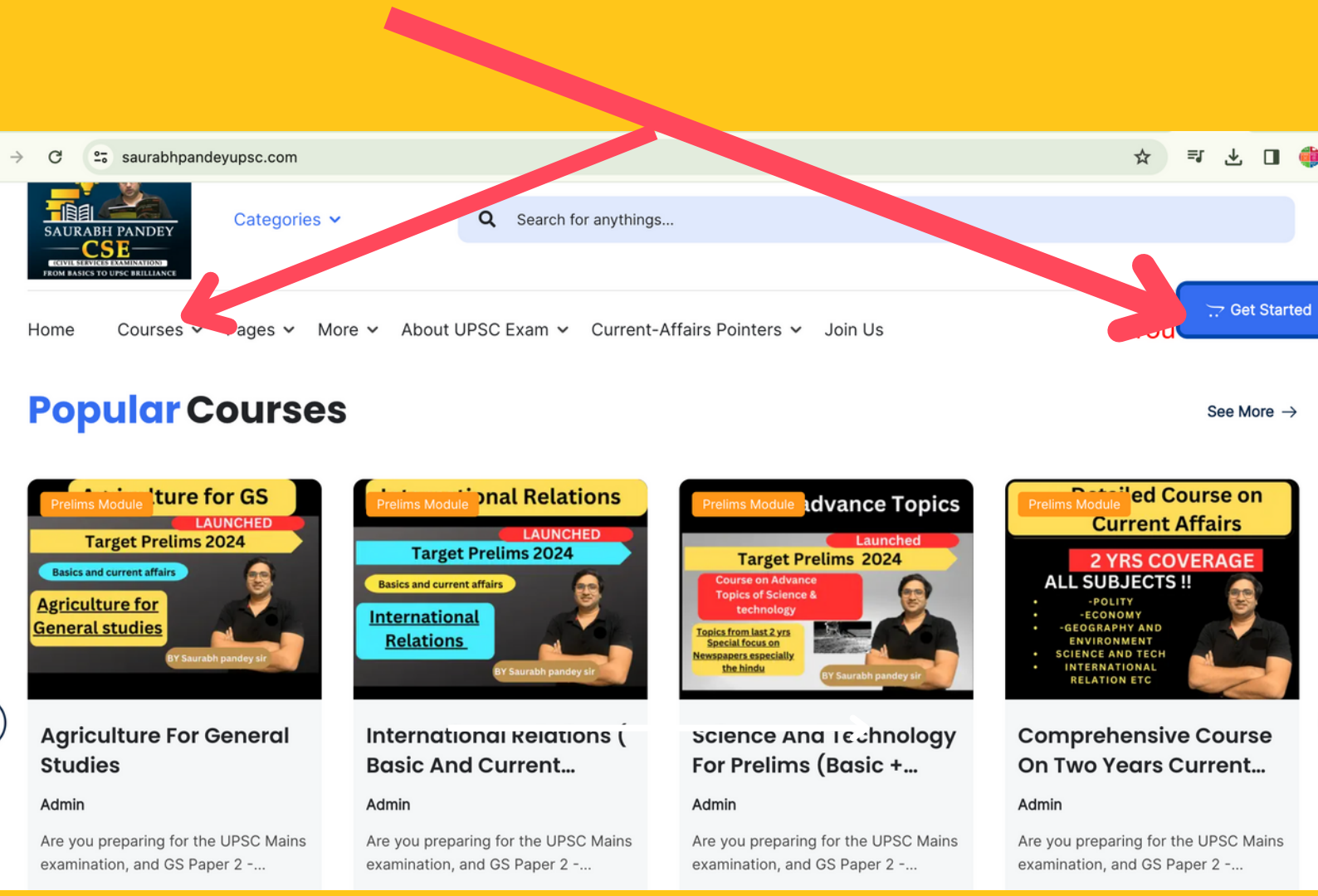

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Scientists build a camera to 'show' how animals see moving things

Animal-vision video could help people navigate wild landscapes without hurting camouflaged animals; help farmers spot fruit pests invisible to the human eye but readily visible to animals that have evolved to eat those fruits; and even transform the way wildlife documentary films are made

Sanjukta Mondal

To most people, leaves are green and oranges are orange. But if our pets could speak, they'd disagree.

We know there are many different ways to 'see' the world because that's the diversity we have found in animals. Organisms with the ability to see have two or more eyes that capture light reflected by different surfaces in their surroundings and turn it into visual cues. But while all eyes have this common purpose, the specialised cells that respond to the light, called photoreceptors, are unique to each animal.

For instance, human eyes can only detect wavelengths of light between 380 and 700 nanometres (nm); this is the visible range. Honey bees and many birds on the other hand can also 'see' ultraviolet light (10-400 nm).

While the human visual range is relatively limited, it hasn't abated humans' curiosity about how animals see the world.

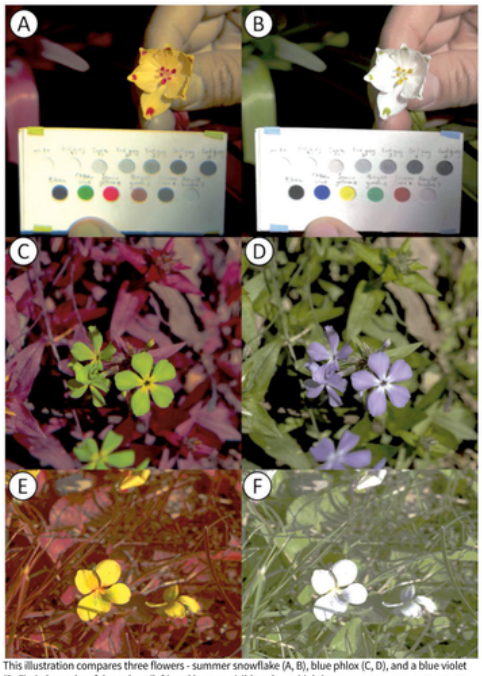
Thankfully we don't have to imagine too much. Researchers at the University of Sussex and the George Mason University (GMU) in the U.S. have put together a new camera with the ability to view the world like animals do. In a paper published in *PLoS Biology*, the team has written their device can even reveal what colours different animals see in motion, which hasn't been possible so far.

Making the invisible visible

Animals use colours to intimidate their predators, entice mates or conceal themselves. Detecting variations in colours is thus essential to an animal's survival. Animals have evolved to develop highly sensitive photoreceptors that can detect light of ultraviolet and infrared wavelengths; many even notice polarised light as part of their Umwelt - the biological systems that make a specific system of meaning-making and communication possible.

Neither human eyes nor most commercial cameras have been able to tap into this unchartered territory of animal vision. In the new study, exponents of biology, computer vision, and programming came together to create a tool that could record and track the complexity of animal visual signalling.

The tool combined existing multispectral photography techniques with a new camera setup and a beam-splitter (to separate ultraviolet and visible light), all encased in a custom 3D-printed unit. The system recorded videos simultaneously in visible and ultraviolet channels in natural lighting. They fed the camera output through some code (written in Python) that could convert the visual data to the physical signals produced by photoreceptor cells.



This illustration compares three flowers - summer snowflake (A, B), blue phlox (C, D), and a blue violet (D, E) - in honeybee false colour (left) and human-visible colours (right). VASAS V, ET AL., 2024, PLOS BIOLOGY, CC-BY 4.0

Finally, the researchers modified these signals based on what they already knew about how an animal's photoreceptors work, and produced videos true to what that animal might see. These used false colours in these videos so that, for example, a particular colour could stand in to show ultraviolet imagery.

In sum, the camera system translated what animals see in visible and non-visible light into colours compatible with the human eye.

The time challenge

You may have already seen false-colour images - like when you saw the Hubble space telescope's iconic snap of the 'Pillars of Creation'. The stars and nebulae don't actually look that resplendent to human eyes. They are coloured that way to show what the telescope saw in, say, infrared or radio wavelengths. Scientists have also used false-colour images to understand how flowers reflect ultraviolet light to influence the behaviour of insects nearby.

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But false colours can only stand in for so much. According to the researchers, existing techniques to visualise the colours animals see require object-reflected light to predict how an animal's photoreceptor would respond or require a series of photographs in wavelengths beyond human vision (with the help of bandpass optical filters). Both scenarios require the subject to be motionless. The new system can visualise free-living organisms in their natural settings, however.

In addition, Pavan Kumar Reddy Katta, a graduate teaching assistant at GMU and one of the study's authors, said the team wrote a program that could accept both ultraviolet- and visible-light data and spit out complete videos. "We made use of a continuous stream which allowed us to resolve our data at various points of space and time and produce real-time visualisations in animal-vision," he told this author.

The next big thing in animal vision

Equipped with the new camera, the research team checked what the flower black-eyed Susan (*Rudbeckia hirta*) looks like to honey bees (*Apis mellifera*).

"To our eye, the black-eyed Susan appears entirely yellow because in the human-visible range, it reflects primarily long wavelength light," the team wrote in its paper. "Whereas in the bee false colour image, the distal petals appear magenta because they also reflect ultraviolet, stimulating both the ultraviolet-sensitive photoreceptors ... and those sensitive to green light ... By contrast, the central portion of the petals does not reflect ultraviolet and therefore appears red."

According to the paper, the visual mechanisms animals have evolved to communicate and protect themselves could help solve many of our detection problems. For example, the animal-vision video could help people navigate wild landscapes better and without hurting camouflaged animals. It can help farmers spot fruit pests that are not visible to the human eye but are readily visible to animals that have evolved to eat those fruits.

Daniel Hanley, assistant professor at GMU and the study's corresponding author, said their invention could even transform the way wildlife documentary films are made.

The camera system could allow filmmakers and ecologists to record the animal world through a new lens and create new visual experiences. He also said the platform's striking images could be used to communicate the science of the living world to young audiences.

"We are thinking of creating a science exhibit for children using our setup, flowers, and live animals," Dr. Hanley said. "Where children can just click a button to experience what a snake might see or a honeybee might see."

(Sanjukta Mondal is a chemist-turned-science-writer with experience in writing popular science articles and scripts for STEM YouTube channels.)

THE GIST

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Animal vision

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WHAT IS IT?

IceCube: the big, chill neutrino-spotter

Vasudevan Mukunth

The IceCube neutrino observatory is a device at the earth's South Pole that detects subatomic particles called neutrinos. It was built and is maintained by the IceCube Collaboration, which consists of many universities worldwide led by the University of Wisconsin, Madison. IceCube consists of thousands of sensors buried more than 1.4 km beneath the ice plus multiple detectors above the surface.

Neutrinos are light particles that very rarely interact with matter. This is why they're called "ghost particles". By some estimates, a human-sized neutrino detector will have to wait for a century for a single neutrino to interact with a sensor. The larger the detector's collecting area, the higher the chances of spotting neutrinos. IceCube is the world's biggest 'neutrino telescope'; its sensors are distributed throughout a cubic kilometre of ice.

When a neutrino interacts with the ice surrounding the sensors, it may produce some charged particles and some radiation. The sensors detect the radiation to infer the detection of a neutrino and use the radiation's properties to understand more about the particle. Neutrinos come in different types. IceCube can identify some of them in real-time. For others, IceCube collects data for many years and scientists then comb through them to find neutrino interaction events.

Most of the energy of a collapsing supernova is radiated in the form of neutrinos, produced when protons and electrons in the nucleus combine to form neutrons. NASA

In such an instance, scientists reported last week they had found instances in IceCube's data from 2011 to 2020 that matched the signature of tau neutrinos, with more than 99.999999% confidence.

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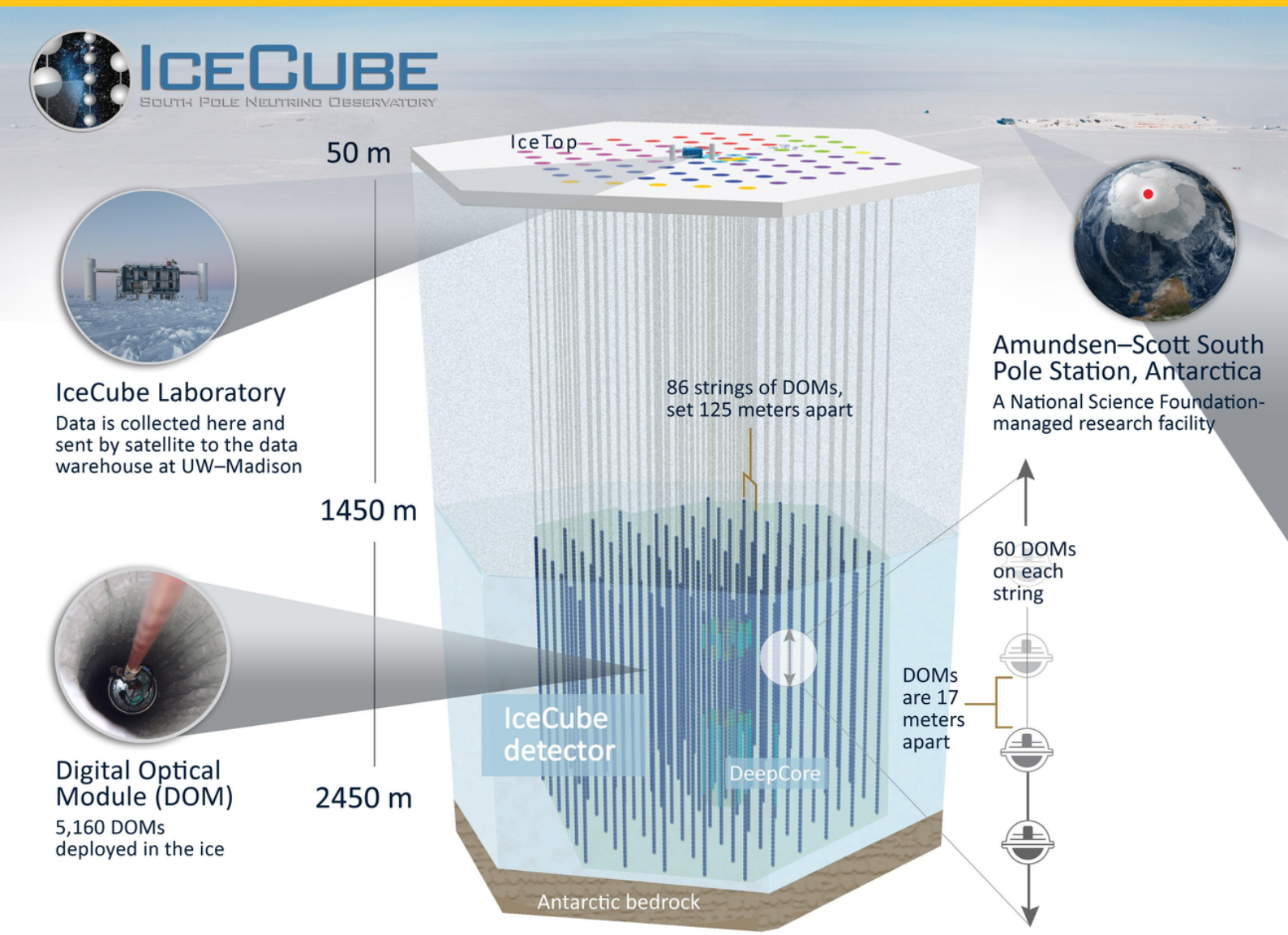

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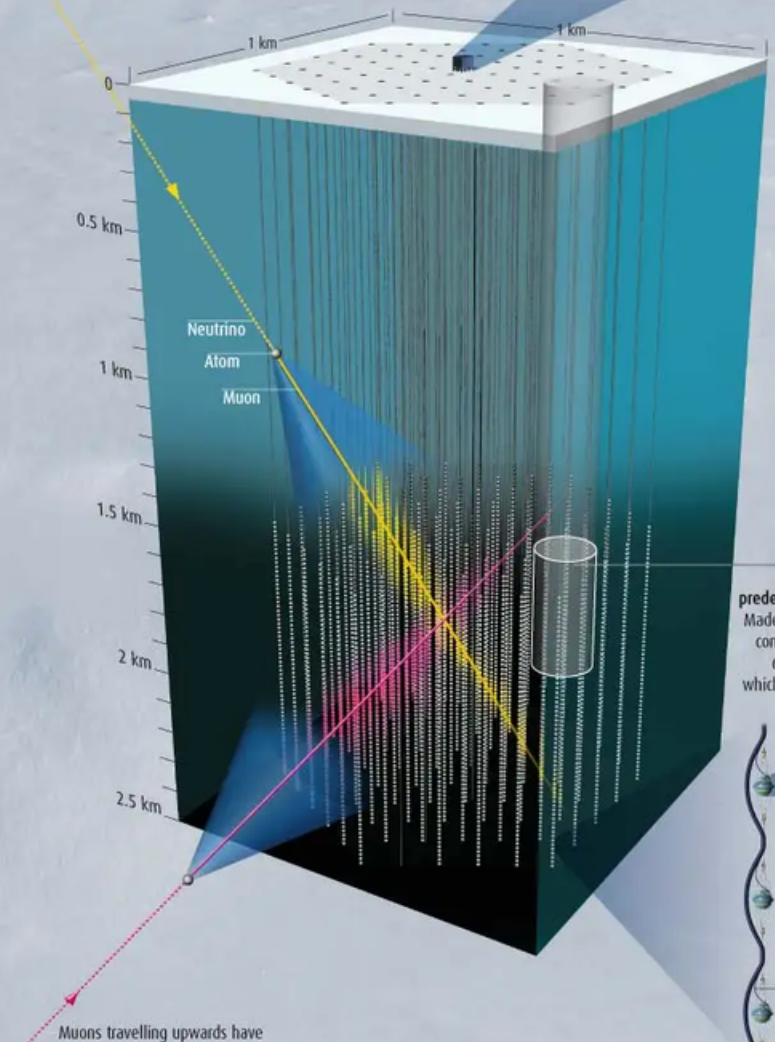
ICE DREAM

The IceCube detector will use a cubic kilometre of Antarctic ice to spot passing neutrinos. Currently half-built, it is already the world's biggest neutrino detector and is designed to pick up signs of neutrinos from astrophysical objects

IceCube laboratory
Houses the computers and other electronics

ATMOSPHERIC AND ASTROPHYSICAL NEUTRINOS
Some neutrinos will interact with nuclei in the ice and release a muon. Travelling faster in ice than light can, the muon radiates blue Cerenkov light that is picked up by the strings of light sensors. These signals are used to reconstruct each muon's path, revealing the neutrino's direction

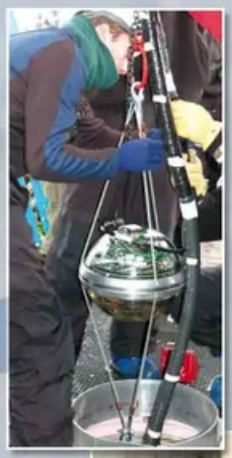


Muons travelling upwards have come from neutrinos that have passed through the Earth

ATMOSPHERIC AND ASTROPHYSICAL NEUTRINOS

Hot water station
Used for drilling holes in the ice

The drill
Hot water is forced through a nozzle, leaving a hole 0.5 metres wide in the ice



IceCube's predecessor AMANDA
Made up of 19 strings containing a total of 680 light sensors, which are now part of IceCube

Cables
Light signals are relayed to the surface

Light sensors
80 strings holding 60 sensors each are lowered into the holes. This has to be done quickly before the water in the hole refreezes

SOURCE: NSF, ANIL ANANTHASWAMY

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THE HINDU

How were the new Election Commissioners selected?

What does the law say on the appointment process? Why has the new Act been challenged?

K. Venkataramanan

The story so far:

The President has appointed Gyanesh Kumar and Sukhbir Singh Sandhu, both retired IAS officers, as Election Commissioners (ECs) to fill up two vacancies in the three-member Election Commission of India. The two officials are the first to be appointed under the new law governing appointments to the constitutional body, the Chief Election Commissioner and other Election Commissioners (Appointment, Conditions of Service and Term of Office) Act, 2023.

How were the new ECs selected?

In terms of the new law, the two ECs were selected by a three-member Selection Committee, comprising Prime Minister Narendra Modi, Union Home Minister Amit Shah, and the Leader of the Indian National Congress in the Lok Sabha, Adhir Ranjan Chowdhury, as leader of the largest party in the Opposition. They were chosen out of a shortlisted panel of six names. The shortlisting was done by a committee which, according to the Act, is headed by the Union Minister for Law and Justice and includes two officials of the rank of Secretary to the government.

What was the process before this?

Article 324 of the Constitution vests the "superintendence, direction and control of elections" in an Election Commission. It also says the EC shall consist of the Chief Election Commissioner and such number of other Election Commissioners, if any, as the President may fix from time to time. This provision was subject to any law made in that behalf by Parliament. However, for nearly 40 years from the adoption of the Constitution, the EC only had a Chief Election Commissioner (CEC). It was not until October 1989 that it became a multi-member body. However, the appointment of two Election Commissioners was rescinded within a short time, that is on January 1, 1990.

A law was enacted in 1991 to fix the conditions of service of the CEC and the ECs, and amended in 1993. However, it did not provide for any appointment process. In the absence of any particular process being laid down by parliamentary law, the President has been appointing the CEC and ECs. The only known process is that the Law Ministry puts up a panel of names to the Prime Minister, who recommends the appointment of one of them as EC to the President. It had become a convention to appoint officials as ECs first and then, on the completion of the tenure of the CEC, the senior EC was elevated as CEC.

What did the SC rule on the process?

In *Anoop Baranwal versus Union of India*, a five-member Constitution Bench ruled that it was the intention of the makers of the Constitution that the power to appoint the CEC and other ECs was not meant to be given exclusively to the executive and that the power was to be exercised "subject to any law made by Parliament". Noting that no such law was enacted since the inception of the Constitution, the court laid down an interim arrangement for the appointment. This was to operate until Parliament made its own law. The court said the appointments should be made by a three-member committee comprising the Prime Minister, the Leader of the Opposition in the Lok Sabha (or the leader of the party that is largest in the Opposition) and the Chief Justice of India. It was in response to this that Parliament enacted the 2023 Act, which received presidential assent and was notified late in December 2023.

What is the criticism against the Act?

The foremost criticism from those who have challenged the new Act is that it has removed the CJI from the selection panel and has made a Union Minister a member instead. This gives the executive a two-one majority in the three-member committee. The government has argued that the Act does not really remove the CJI from the appointment process, as the inclusion of the CJI was only a stop-gap arrangement put in place until the enactment of a law. The Supreme Court has repeatedly rejected attempts to obtain a stay on the new Act. The petitioners have approached the court again against the appointment of the two ECs. Their primary argument is that the Act violates the main principle in the Constitution Bench judgment – the need to free the appointment process from the executive.

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Election commissioner appointment

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THE HINDU

The problem of equity in IPCC reports

What underpins mitigation action in assessment reports by the UN Intergovernmental Panel on Climate Change? What are Integrated Assessment Models? Do these models follow the principle of equity? What did the latest study find with respect to over 500 future emissions scenarios?

EXPLAINER

Rishika Pardikar

The story so far:

In a study published on March 4, researchers analysed more than 500 future emissions scenarios the UN Intergovernmental Panel on Climate Change (IPCC) assessed in its latest reports. These scenarios relate to mitigation actions like reducing carbon dioxide emissions from burning fossil fuels and increasing carbon sequestration through forestry. It found that across all 556 scenarios, income, energy-use, and emissions disparities between developed and developing countries are projected to continue up to 2050.

What are IPCC assessment reports?

Typically, IPCC reports comprise three Working Group reports: one on physical science, one on climate adaptation, and one on mitigation action. One synthesis report consolidates findings from the three Working Group reports. Then there are thematic special reports. Each report assesses climate-related scientific literature to capture the state of scientific, technical, and socio-economic knowledge on climate change. The IPCC is currently in its Seventh Assessment cycle (AR7).

How does it assess future scenarios?

The IPCC uses 'modelled pathways' to estimate what it will take to limit the warming of the earth's surface. These pathways are drawn using Integrated Assessment Models (IAMs) that describe human and earth systems. IAMs are complex models that examine possible futures of the energy and climate system and economies. Its macroeconomic models can point to future growth levels in terms of GDP; its energy models can project future consumption; vegetation models can examine land-use changes; and earth-system models use the laws of physics to understand how climate evolves. With such integration across disciplines, IAMs are meant to provide policy-relevant guidelines on climate action. However, these models also have shortcomings. They prioritise least-cost assessments – for example, the absolute cost of setting up a solar plant or undertaking afforestation in India is lower than in the U.S. However, experts have said they could exercise the option of enabling countries to equitably share the burden of action, where the richest undertake more drastic mitigation action more immediately.

Equitable action: A solar thermal power plant in Maraimalai Nagar, Tamil Nadu in 2023. FILE PHOTO

What did the new study find?

The study was conducted by Tejal Kanitkar and Akhil Mythri from the National Institute of Advanced Studies, Bengaluru, and T. Jayaraman from M.S. Swaminathan Research Foundation, Chennai. They assessed 556 scenarios in IPCC's AR6 report and found they project that per-capita GDP across Sub-Saharan Africa, South Asia, West Asia and the rest of Asia, which together constitute 60% of the world's population, will be below the global average even in 2050. They spotted similar inequities between the Global North and the Global South vis-à-vis the consumption of goods and services and both energy and fossil fuel consumption.

The scenarios were also found to project higher carbon sequestration from land-based carbon sinks (like forests) and higher deployment of carbon capture and storage (CCS) technologies in developing countries compared to developed ones. Thus, poorer countries, they concluded, would bear the burden of both mitigation action and carbon dioxide removal and CCS. "Our analysis of the regional trends underlying the global modelled scenarios in the IPCC's [AR6] indicates that the scenarios disregard the notion of historical responsibility of the Global North," the authors wrote in their paper, adding the scenarios also "disregard" the future energy needs of the Global South to meet development goals.

Why does equity matter?

The principles of equity and common but differentiated responsibilities are enshrined in the UN Framework Convention on Climate Change (UNFCCC). Article 3 of the Convention states countries "should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effects thereof."

These principles recognise that while tackling climate change requires global action, richer countries are better placed to shoulder bigger climate action responsibilities than poorer ones. By viewing climate action solely through the lens of global-level technical and economic feasibility, mitigation pathways modelled using IAMs often run counter to equity principles, researchers say. "Equity in this sense would imply that developed regions need to accelerate towards net negative emissions and make the remaining carbon budget available to other less developed regions. However, the scenarios project precisely the opposite," they wrote in their paper.

In the study, the authors conclude that construction of IPCC scenarios will need to be both equitable and environmentally sound. "This is currently a major gap in the emissions modelling domain and we need to move towards model and scenario building techniques where questions of equity and climate justice come to the foreground," they wrote.

Rishika Pardikar is a freelance environment reporter based in Bengaluru

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THE HINDU

Many elections, AI's dark dimension

M.K. Narayanan

is a former Director, Intelligence Bureau, a former National Security Adviser, a former Governor of West Bengal, and a former Executive Chairman of CyQureX Private Limited, a U.K.-U.S. cyber security joint venture

With a series of elections to be held across the world in 2024, the potential of AI to disrupt democracies cannot be dismissed

The rapid development of Artificial Intelligence (AI) models suggests that we are at an inflection point in the history of human progress. The speed with which the development of newer skills is taking place suggests that the day is not far off when Generative Artificial Intelligence (GAI) will transform into Artificial General Intelligence (AGI), which can mimic the capabilities of human beings. Such a situation could revolutionise our ideas about what to expect from machines. Breakthroughs in the AI domain will bring about a new chapter in human existence, including the way people react to both facts and falsehoods.

The potential of AI is already clear. Many such as Sam Altman of OpenAI in the United States, believe that it is the most important technology in history. AI protagonists further believe that AI is set to turbocharge, and dramatically improve, the standard of living of millions of human beings. It is, however, unclear, as of now, whether, as many Doomsday sayers aver, whether AI would undermine human values and that advanced AI could pose 'existential risks'.

AI and the electoral landscape

With the seven-phase general election in India having been announced, and to be held from April 19 to June 1, 2024, political parties and the electorate cannot, however, afford to ignore the AI dimension. This year, elections are also scheduled to be held (according to some reports) in as many as 50 other countries across the globe, apart from, and including, India, Mexico, the United Kingdom (by law, the last possible date for a general election is January 28, 2025) and the United States.

These elections are set to alter the fate of millions of people, and policymakers and the electorate need to ponder over the positive and negative impacts of this new technology. Rapid technological breakthroughs in AI (especially its latest manifestation, such as Generative AI, that provides dynamic simulations and mimics real world interactions) carry their own burdens. It may be too early to fully contemplate the possible impact of AGI– AI systems that simulate the capability of human beings – but all this is indicative of yet another dimension to electoral dynamics that cannot be ignored.

It may, hence, not be wrong to consider the elections of 2024 as a curtain-raiser to whether AI and its offerings (such as Generative AI) would prove to be a game changer. The world is by now aware that AI models such as ChatGPT, Gemini, Copilot are being employed in many fields, but 2024 would be a test case as to whether AI's newer models could alter electoral behaviours and verdicts as well. The good news, perhaps, is that those wishing to employ Generative AI to try and transform the electoral landscape do not have adequate time to fine-tune their AI models. It would, however, still be a mistake to underestimate the extent to which AI could impact the electoral landscape this time as well. What might not happen in 2024, may well happen in the next round of elections, both in India and worldwide.

A recently published Pew Survey (if it can be treated as reliable) indicates that a majority of Indians support 'authoritarianism'. Those employing AI could well have a field day in such a milieu to further confuse the electorate. As it is, many people are already referring to the elections in 2024 worldwide as the 'Deep Fake Elections', created by AI software. Whether this is wholly true or not, the Deep Fake syndrome appears inevitable, given that each new election lends itself to newer and newer techniques of propaganda, all with the aim of confusing and confounding the electorate. From this, it is but a short step to the inevitability of Deep Fakes.

Tacking AI 'determinism'

AI technology makes it easier to enhance falsehoods and enlarge mistaken beliefs. Disinformation is hardly a new methodology or technology, and has been employed in successive elections previously. What is new is that sophisticated AI tools will be able to confuse the electorate to an extent not previously known or even envisaged. The use of AI models to produce reams of wrong information, apart from disinformation, accompanied by the creation of near realistic images of something that does not exist, will be a whole new experience. What can be said with some degree of certainty is that in 2024, the quality and quantity of disinformation is all set to overwhelm the electorate. What is more worrying is that the vast majority of such information would be incorrect. Hyper realistic Deep Fakes employed to sway voters, and micro targeting are set to scale new heights.

The potential of AI to disrupt democracies is, thus, very considerable. Simply being aware of the disruptive nature of AI and AI fakes is not enough. It may be necessary, for democracies in particular, to prevent such tactics from distorting the 'thought behaviour' of the electorate. AI deployed tactics will tend to make voters more mistrustful, and it is important to introduce checks and balances that would obviate efforts at AI 'determinism'. Notwithstanding all this, and while being mindful of the potential of AGI, panic is not warranted. There are many checks and balances available that could be employed to negate some of AI's more dangerous attributes.

The wide publicity given to a spate of recent inaccuracies associated with Google is a timely reminder that AI and AGI cannot be trusted in each and every circumstance. There has been public wrath worldwide over Google AI models, including in India, for their portrayal of persons and personalities in a malefic manner, mistakenly or otherwise. These reflect well the dangers of 'runaway' AI.

Inconsistencies and undependability still stalk many AI models and pose inherent dangers to society. As its potential and usage increases in geometric proportion, threat levels are bound to go up. As of now, even as the potential of AI remains very considerable, it tends to be undependable. More so, its 'mischief potential' cannot be ignored.

As nations increasingly depend on AI solutions for their problems, it is again important to recognise what many AI experts label as AI's 'hallucinations'. In simple terms, what these experts are implying is that 'hallucinations' make it hard to accept and endorse AI systems in many instances. What they further imply, specially in the case of AGI, is that it tends at times to make up things in order to solve new problems. These are often probabilistic in character and cannot be accepted *ipso facto* as accurate. The implication of all of this is that too much reliance on AI systems at this stage of development may be problematic. The stark reality, though, is that there is no backtracking from what AI or AGI promises, even if results are less dependable than one would like.

We cannot also afford to ignore other existential threats associated with AI. The dangers on this account pose an even greater threat than harm arising from bias in design and development. There are real concerns that AI systems, oftentimes, tend to develop certain inherent adversarial capabilities. Suitable concepts and ideas have not yet been developed to mitigate them, as of now. The main types of adversarial capabilities, overshadowing other inbuilt weaknesses are: 'poisoning' that typically degrades an AI model's ability to make relevant predictions; 'back dooring' that causes the model to produce inaccurate or harmful results; and even 'evasion' that entails resulting in a model misclassifying malicious or harmful inputs thus detracting from an AI model's ability to perform its appointed role. There are possibly other problems as well, but it may be too early to enumerate them with any degree of probability.

India's handling of AI

Elections apart, India being one of the most advanced countries in the digital arena, again needs to treat AI as an unproven entity. While AI brings benefits, the nation and its leaders should be fully aware of its disruptive potential. This is specially true of AGI, and they should act with due caution. India's lead in digital public goods could be both a benefit as well as a bane, given that while AGI provides many benefits, it can be malefic as well.

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AI and Electoral landscape

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A farmer looking at his crop in a field in Vietnam's Mekong Delta region, known as the country's rice bowl'. AFP

Vietnam's 'rice bowl' about to crack as saltwater levels rise

Agence France-Presse
HANOI

Vietnam faces nearly $3 billion a year in crop losses as more saltwater seeps into arable land, state media reported on Sunday, citing new research.

The damage would likely centre on the Mekong Delta region, known as "Vietnam's rice bowl" because it provides food and livelihoods for tens of millions of people, research from the country's Environment Ministry showed.

Saltwater levels are often higher in the dry season but they are intensifying due to rising sea levels, droughts, tidal fluctuations, and a lack of upstream freshwater.

The resulting crop losses could amount to 70 trillion dong ($2.94 billion), state media VnExpress reported, citing new research from the Water Resources Science Institute, which is under the Environment Ministry.

The research presented at a conference on water resourse management on Friday, found that among the most impacted parts of the region would be the southernmost Ca Mau province, which could lose an estimated $665 million.

Earlier this month, the Department of Water Resources warned saline intrusion could impact around 80,000 hectares of rice and fruit farms in the Mekong Delta.

Salt intrusion in the area between 2023-2024 was higher than the average, according to the National Center for Hydro-Meteorological Forecasting.

The delta suffered an unusually long heatwave in February, leading to drought in several areas and low water levels in the region's canals.

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Mekong Delta and rice

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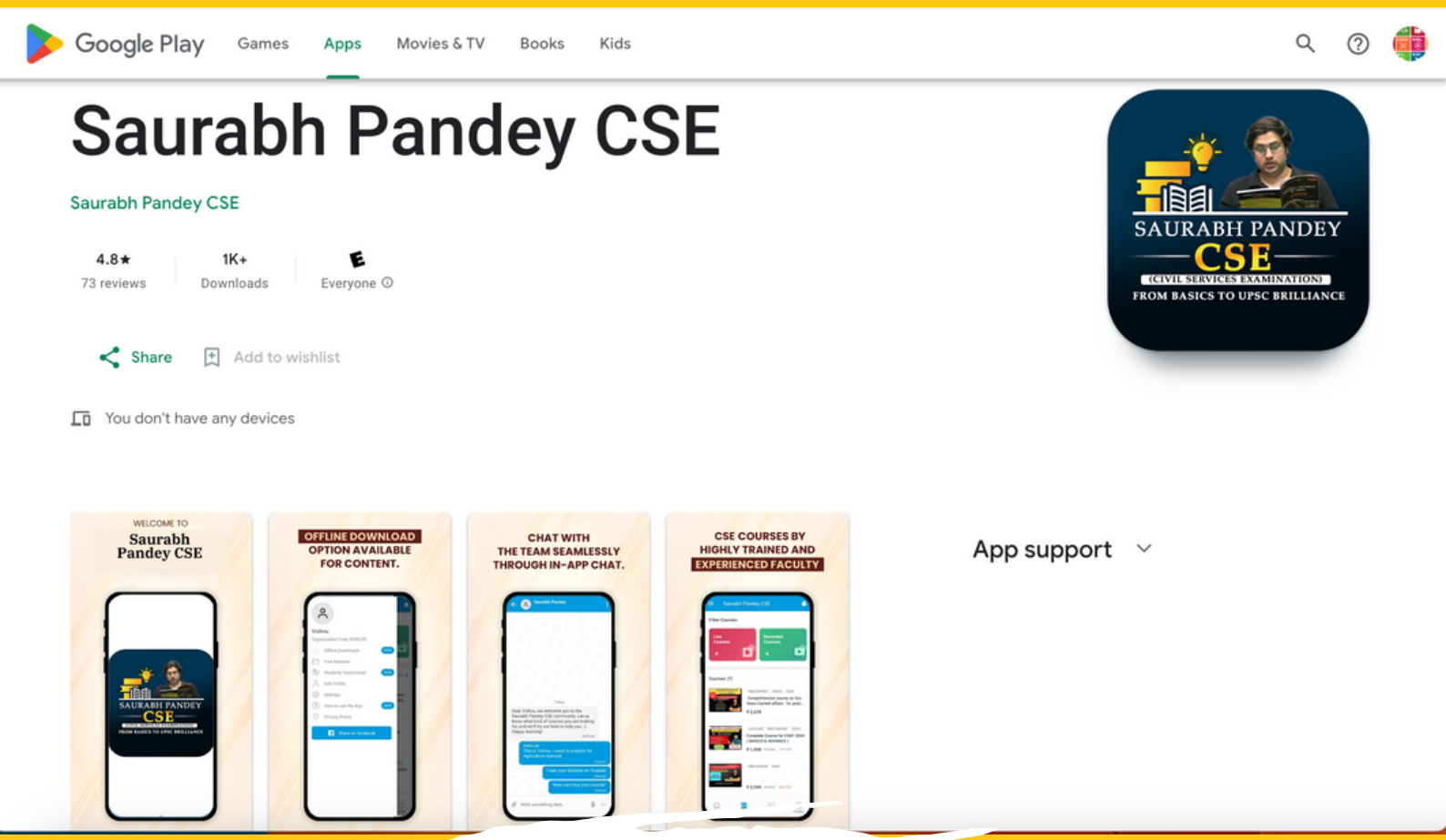

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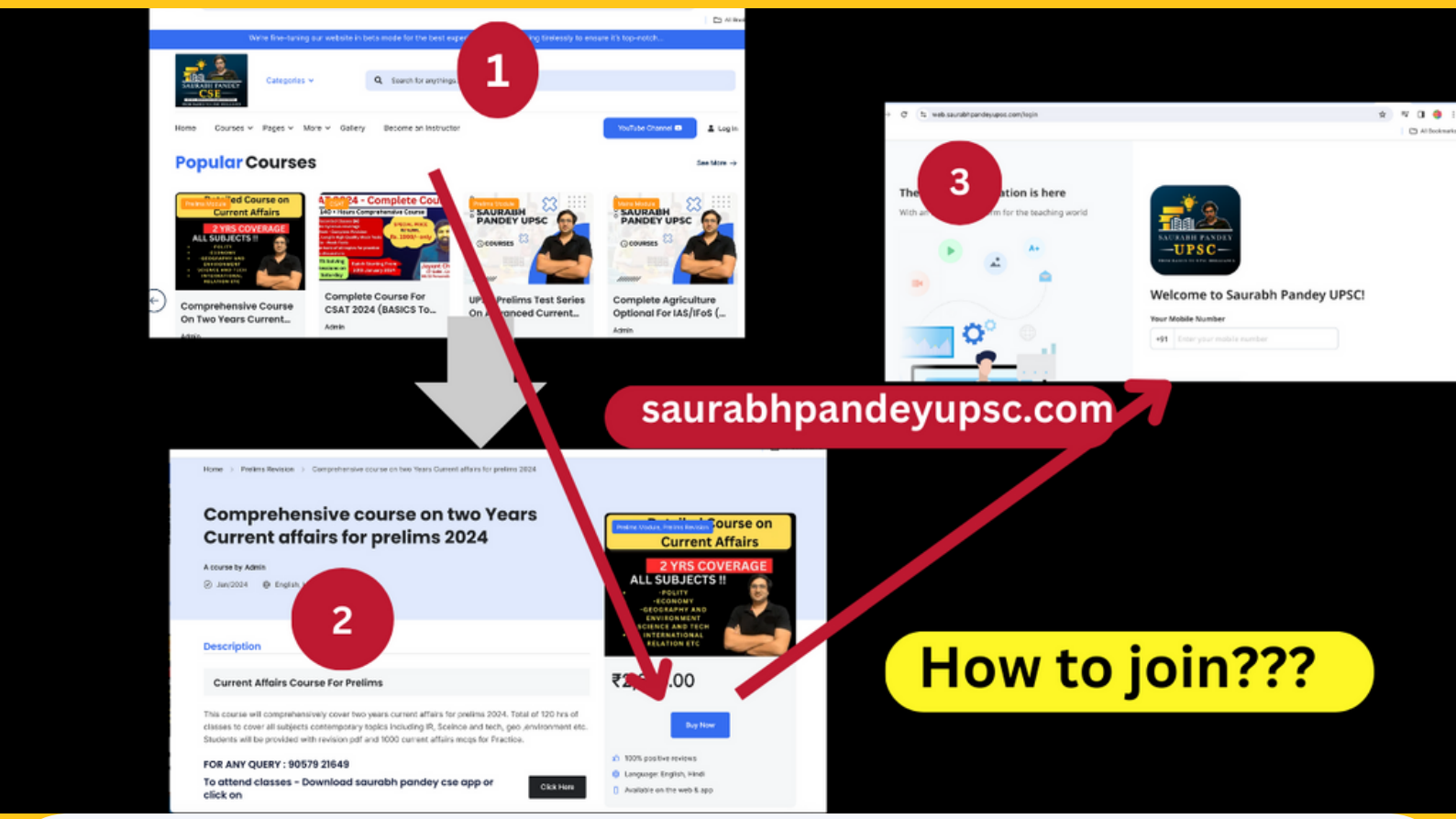

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