Department of Mechanical & Aerospace Engineering

The George Washington University

Guest Talk :

Innovation @ IOT+Human Behaviour+Finance

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About the guest :

1998-2017 : Launched 5 startups - 3 of which grew up to unicorns

Since 2017, run my boutique Investment Bank (*ShiftAltCap*) - work with deep tech / tech enabled startups. I deliver 3 specific values viz.

a) Curation
b) Clients
c) Capital

Mentored, grew their business & raised US $ 40 Mn for 24 startups.

Jury for FinTechs and AI startups with NASSCOM

Also run curated portfolios of innovative businesses listed on NYSE.

Practitioner

Flow of the talk :

a) Purpose of the talk.

b) IOT : Key elements, Challenges, Landscape, market and leading players, Key use cases.

c) Human behaviour : vis-a-vis IOTs.

d) Finance : role in IOT ecosystem - and converse too.

e) The confluence : unique opportunities to build valuable businesses.

Practical & Actionable Outcomes

IOT : key elements, Challenges, Landscape, market and leading players, Key use cases.

IOT is the network of interconnected devices embedded with sensors, software, and communication technologies, enabling them to collect, exchange, and act on data over the internet without human intervention.

Elements in the IoT Ecosystem

1. **Devices and Sensors:** Collect data from the environment or users (e.g., smart thermostats, wearables).
2. **Energy & Connectivity:** Networks that power the devices and transmit data (Wi-Fi, Bluetooth, LoRaWAN, 5G).
3. **Computing:**
   a) **Cloud:** Stores and processes vast amounts of data generated by IoT devices.
   b) **Edge:** Process data closer to source, reducing latency.
4. **IoT Platforms:** Provide systems and tools for device management, analytics & integration.
5. **Intelligence**: AI & ML - analyze IoT data for insights, training - and automation to facilitate scalability.
6. **Cybersecurity:** Protects data and devices from unauthorized access.

Key use cases

1. Manufacturing
2. Healthcare
3. Agriculture
4. Smart Homes
5. Retail
6. Logistics
7. Environment Monitoring
8. Energy Management
9. Smart Cities
10. Finance

Leading players

1. Cisco - kinetic platform
2. Bosch - industrial & home
3. IBM - Watson IOT platform
4. Google - NEST, Cloud IoT Core
5. PTC - ThingWorx
6. GE Digital - Predix platform
7. Verizon - 5G and NB-IOT
8. SAP - Business Technology Platform
9. Siemens - Insights Hub, SIMATIC, Mendix
10. Tesla, John Deere - mobility

Challenges

1. Security
2. Interoperability
3. Energy efficiency

Threats

1. Quantum Computing
2. Cybersecurity Risks
3. Regulatory Challenges

Expected : 50 Billion IoT connected devices by 2035 (*>6/human*)

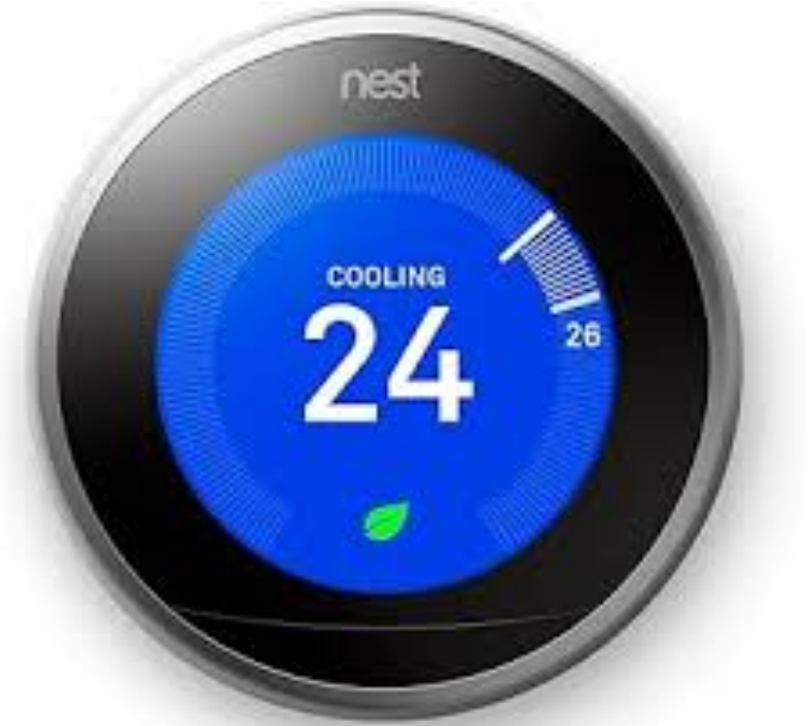
Human behaviour

We think we behave rationally - but Nobel Prize winners Kahneman (2002) and Thaler (2017) demonstrated that humans often make irrational choices. Their theories on behavioural economics have pioneered concepts like 'nudge'.

'Nudge' : alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives.

It's about 'guiding' (or nudging) choice — not restricting it.

‘Nudge’ in action in IOT



Smart thermostats like **Google Nest** use IoT sensors & learning algorithms to enable homeowners reduce energy usage.
The way they do it is through *nudges*, not mandates.

Default Settings: The thermostat is pre-programmed with energy-efficient temperature settings, but users can change them any time.

⟶ *Nudge: People are more likely to stick with the default.*

Leaf Icon Cue: When users choose energy-efficient temperatures, a green **leaf icon** appears on the screen.

⟶ *Nudge: Provides positive reinforcement, signalling “good behavior” without punishing other choices.*

Monthly Energy Reports: Nest emails users a simple summary comparing their energy usage with neighbours (anonymously), encouraging better habits.

⟶ *Nudge: Social proof makes people want to "do better" than average.*

Behavioural impact:

- Users reduce energy consumption ***without being forced*** to : often saving 10–15% on energy bills.
- The system doesn't penalise inefficient settings but subtly encourages better ones.
- It leverages defaults, gamification (*the leaf*), and social norms to influence choices.

Respects freedom of choice, changes behavior predictably, and is low-cost to implement — all hallmarks of effective nudges.

Finance :

IoT is playing an increasingly transformative role in finance sector by enhancing efficiency, improving customer experiences, and enabling smarter decision-making.

Some use cases :

1. Enhancing customer experience (CX) : through wearables, mobile apps, smart contactless payments, etc.
2. Improve operational efficiency : through IOT enabled ATMs that never run out of cash.
3. Fraud detection : IOT devices plus machine learning identify patterns to detect outliers in real time.
4. Credit risk management : IoT enabled assets enable assessing condition of asset financed / insured.
5. Business insights : customers behavioural data analytics identifies patterns and predicts emerging needs.
6. Trade finance : by tracking IoT enabled shipments, inventory and production processes in real time.
7. Compliance : IoT devices collecting data enable reporting to financial regulators and strengthen compliance.

Our most irrational decisions are regarding money : ‘Nudge’ helps.

Nudge in Finance through IOT :

An every day use case for students :

You have a goal : buying a car, or a PS-5 console or paying off your student debt - within a specific time frame.

IoT connected wallets linked to specific goals monitor your spending and saving, use behavioural nudges to encourage better financial decisions - and keep you on track to reach your goal.

The ‘Nudge’ in action :

- When you’re about to make a non-essential purchase, the wallet/app **vibrates** gently as a reminder of your savings goal.
- Some wallets even *lock themselves* (digitally) for a set period unless you override it manually.
- The app might show a real-time progress bar toward a vacation fund if you skip a purchase.

This uses **timely, non-coercive cues** to slow impulsive behavior and promote delayed gratification — a classic Thaler nudge

Mental accounting, delayed gratification, invincibility bias, FOMO

The confluence : plus a suggested activity for students

When IOT enabled devices/systems plus the reward/penalty of money are used to 'nudge' human behaviour, that tri-junction is where the magic of innovation happens.

The Project :

1. Start with the map of Washington DC : study all high traffic areas where traffic volume routinely leads to traffic jams and those areas which witness high traffic violations.
2. Talk to the traffic police control room to understand their analysis of traffic jam patterns, and how they modulate the duration of red-green timings to manage the flow at different hours of the day.
3. Study the technical architecture or traffic lights to understand how they use embedded sensors to collect real time data, and the system that enables then to use the embedded smart camera's to collect evidence to penalise traffic violations.
4. Present your conclusions (with data and analysis) to Prof Karthik Bulusu on whether and how IOT and a combination of financial penalty are nudging drivers to reduce traffic violations and improve driving behaviours.
5. In addition, make a list of problems that can be solved by a combination of IoT devices and a combination of financial reward & penalty. For the top problems adjudged by Prof Bulusu (*based on the extent of the impact and scalability potential*), use my simple 7 question format to evaluate whether your idea can solve a real problem, whether people will pay for it and to possibly convert into a startup.
6. Last action - create a business case on whether and how it can be converted into a startup in collaboration with the GW Office of Innovation and Entrepreneurship (OIE) and the GW New Venture Competition.

The future has arrived : are ***you*** ready ?

Thank you for your time !

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