

## **Reimagining surveillance to eradicate child abduction in India**

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The goal of this paper is to explain the need to reimagine surveillance in India for the upcoming years so that it can support to abolish the major crime of child abducting. The focus will be on how nature can inspire in designing better and can act as an inspiration for emerging technologies.

## Executive Summary

India has a high volume of child trafficking. There have been many cases where children just disappear overnight, as many as one every eight minutes, according to the National Crime Records Bureau. In some cases, children are taken from their homes to be bought and sold in the market. In other cases, children are tricked into the hands of traffickers by being presented an opportunity for a job, when in reality, upon arrival they become enslaved.

In India, there are many children trafficked for various reasons such as labour, begging, and sexual exploitation. Because of the nature of this crime; it is hard to track; and due to the poor enforcement of laws, it is difficult to prevent. Because of this, it is impossible to have exact figures regarding this issue.<sup>1</sup> India has a staggering statistic of missing children which might gradually increase and make the situation even worse in near future. Thus, it's time to address this issue immediately. In this transdisciplinary unit, I take the opportunity to approach this issue by considering various fields such as Design, science, technology. From the lens of philosophy/concept/theory: Nature as an inspiration to design better, I will be viewing in the context to eradicate child abduction in India using the emerging technologies. This paper is a research result of curiosity to understand how nature has been inspiring in designing better and how it can be applied in the real world problems. Chapter 1 discusses in detail about the crime of child kidnapping in India. Chapter 2 is an understanding of how nature has been inspiring in the evolution of design history. Chapter 3 explores the emerging technologies and to reimagine surveillance in India. Chapter 4 discusses the proposed system addressing the issue. Chapter 5 concludes the research with its outcomes.

Key words: Surveillance, Child abduction, Crime, Nature, Bio-inspiration, Emerging Technologies.

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<sup>1</sup> Wikipedia, The Free Encyclopaedia, s.v. "Child Trafficking in India", (accessed November 07, 2019), [https://en.wikipedia.org/wiki/Child\\_trafficking\\_in\\_India](https://en.wikipedia.org/wiki/Child_trafficking_in_India)

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## Chapter 1: Child Abduction in India

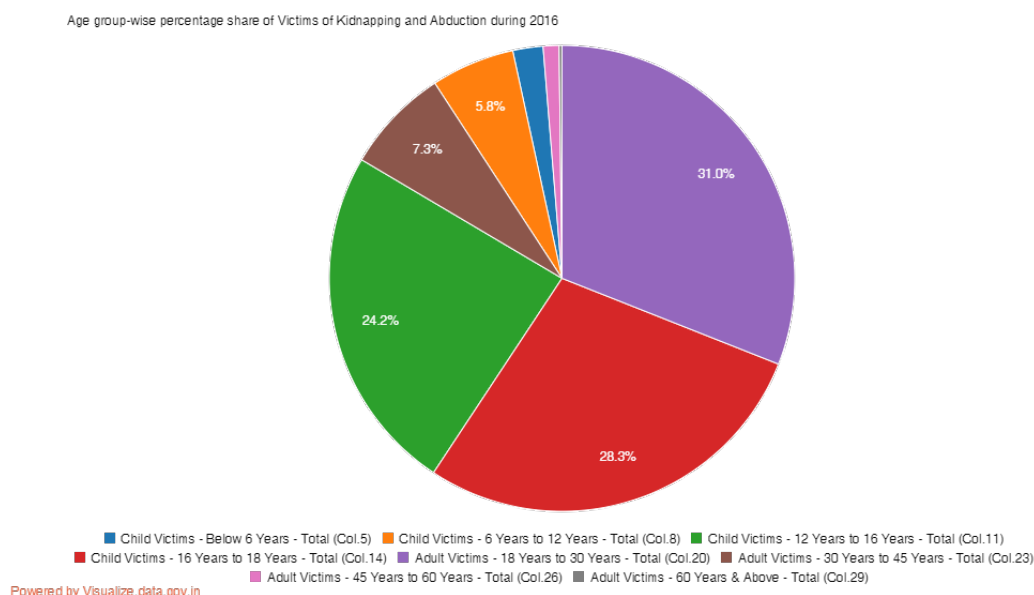
India has the highest rate of child abduction and the staggering statistic is expected to gradually increase in the near future. According to the National Crime Records Bureau and National Informatics Centre<sup>2</sup> the latest record update in 2019 is of the statistics in 2016, total of 89875 Victims of Kidnapping and Abduction (Sec.363 to 369 IPC) reported in India during 2016; Out of which, 23350 (26%) were male Victims and 66525 (74%) were female Victims. Out of these 89875 Victims reported during 2016, 54328 (60.4%) Victims were Children and 35547 (39.6%) Victims were Adults. Of these the average percentage of recovery of kidnapped and abducted child victims was 50.9%.

Total kidnapped and abducted child victims in India was 85100 till 2016, out of which 30772 were unrecovered victims of kidnapping & abduction from previous years and 54328 were kidnapped and abducted during 2016. Out of these 85100 kidnapped and abducted child victims in India till 2016; 43301 (50.9%) were recovered. Recovery of kidnapped and abducted child victims was 11537 (48%) for male and 31764 (52%) for female in India during 2016. With today's crime reports in 2019 child abduction crime has increased and it can be expected that the percentage of this crime will defiantly increase in near future if there is no proper attention taken towards it.

The recorded age group of children getting kidnapped is from 6-18 years being the highest, the male percentage is recorded as 49.9% and female as 51.5%. The (Fig 1-1.) shows graph indicating Age group-wise percentage share of Victims of Kidnapping and Abduction during 2016.

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<sup>2</sup> Open Government Data (OGD) Platform India s.v. "Child Kidnapping", (accessed November 07, 2019), <https://community.data.gov.in/>



*Fig1-1 Visualize.data.gov of kidnapping crime reported*

According to the National Crime Records Bureau during 2016, maximum crime rate of Kidnapping and Abduction was seen in Delhi with 30.8 followed by Assam, Haryana, Chandigarh, Madhya Pradesh, Arunachal Pradesh, Chhattisgarh, Maharashtra, Uttarakhand and Uttar Pradesh with 18.8, 14.2, 10, 9.1, 8.5, 8, 7.7, 7.4 and 7.3 respectively.

To proceed further it is necessary to understand how the children are getting kidnapped and what the purpose of it is. With a close examination of the cases registered in this year 2019<sup>3</sup>, it has been observed that the age group of 6-12 is targeted as they can easily be manipulated by bribing, lack of awareness to be careful in suspicious situation and also lack of knowledge to alert people around them. There are many children trafficked for various reasons such as labour, begging, and sexual exploitation.

Though Child abduction is major in India, the issue is considered as low priority for the Indian government. The Immoral Traffic Prevention Act was first amended in 1956. The act was created to prevent trafficking and sexual exploitation of women and children<sup>4</sup> but the Act

<sup>3</sup> Times of India s.v. "Kidnapping of children", (accessed November 07, 2019), <https://timesofindia.indiatimes.com/topic/kidnapping-of-children/news>

does not provide a clear definition of trafficking. In 2003, India enforced the United Nations Convention against Transnational Organized Crime, which includes three protocols, specifically the Protocol to Prevent, Suppress, and Punish Trafficking in Persons, especially Women and Children. The protocol "provides an agreed upon definition of trafficking in persons. It aims at comprehensively addressing trafficking in persons through the so-called three P's - Prosecution of perpetrators, Protection of victims and Prevention of trafficking."<sup>5</sup>

Thus, there is an immediate need to prevent the issue of child abduction, which is going to increase rapidly in the coming years. Predicting the child kidnapping to be high in the coming year, there is a need to design a system which would give an awareness to the child and alert the crime team when in danger so that an immediate action can be taken.

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<sup>4</sup> Administrator, HRLN s.v. "The Immoral Traffic (Prevention) Act, 1956", (accessed November 07, 2019), [www.hrln.org](http://www.hrln.org)

<sup>5</sup> United Nations Office on Drugs and Crime, (accessed November 07,2019), <https://www.unodc.org/southasia/en/frontpage/2011/may/indian-govt-ratifies-two-un-conventions.html>

## Chapter 2: Nature as an inspiration to design better

Nature is both physical and conceptual, there are many levels within it which can act as bio-inspiration - from the molecules to the biosphere, elements of nature to the flora and fauna and, there are many things that are happening in nature, evolution, creation, destruction, adaption, recycling and many more. To understand the significance of nature on the design, it is necessary to look into history. The upper Palaeolithic age of the man has emerged roughly 300,000 ago, the cave paintings can be considered as the starting point where the man had made the visual mark of the nature to express their idea. Along the history the nature's patterns and textures were not only used to design something aesthetically beautiful but to solve the most complex problems of human. The art movements Impressionism, Art Nouveau, Organic design styles have been an inspiration from the nature with motto to maintain a harmony between man and his environment.

Nature has an evolutionary history for a billion years. Observing and interpreting nature can help us gain principles from it. Human creativity is influenced by a wide variety of factors, nature can act as one of the factors to understand and comprehend the design principles. The term 'nature' here refers to the phenomena of the physical world collectively, including plants, animals, the landscape, and other features and products of the earth, as opposed to humans or human creations<sup>6</sup>.

It is essential to understand the process of nature to understand the form. In this process of observing and appreciating nature, I have acquired the following principles which might have already existed. However, it has helped me to understand the significance of the principles and inspired to implement them in practice.

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<sup>6</sup> Google Dictionary, s.v. "Nature", accessed October 20, 2019.



- Nature's forms are related to their function – Any object in nature takes a particular structure for its purpose to follow the process. Similarly, our designed form should serve a purpose, and it is necessary to give attention to this irrespective of the aesthetics.
- Nature is calm – Nature blends seamlessly with our everyday tasks. Likewise, it's time that our design should communicate the needed information by taking the smallest attention.
- Nature is universal – Nature is universal and is accessible to everyone irrespective of their ability and region, comparably it is required to design universal that is accepted and is useable by all.
- Nature uses only the energy it needs – The strength of the design is to use only the attributes that make the design sustain.
- Nature is recyclable – Nature teaches us to be sustainable. Our aim should be to design to reduce negative impacts on the environment and at the same time, improve lives.
- Nature is collaborative – In a design that requires the collaboration of different disciplinarians, nature is a piece of evidence that collaboration yields the best results.
- Nature taps the limits of innovation – Most of the complex problems can be solved by understanding nature and its process.

## Shapes and forms

Shapes give depth and dimension to our thoughts and they are used to communicate the information in an easier way. Every design consists of different shapes that communicate different message. Similarly, each shape in nature inherit a quality in it, which takes that form

for a particular purpose. The basic shapes from the nature – circle, triangle, and spiral are universally used in design. The following meanings are derived by observing the nature -

### Circle

The circle shape of the sun represents the energy within (Fig 2-1), the circle shape of the earth represents the wholeness (Fig 2-1), and with the shape of the eyeball, it can be a symbol of imagination and vision (Fig 2-3).



2-1 Sun representing the power within 2-2 Earth representing the wholeness 2-3 Eye ball representing the vision  
- Google Images

### Triangle

Mountains are one of the first examples of nature obtaining triangle shape. These mountains give a vision of strength and togetherness as mentioned in the figures (Fig. 2-4 and Fig2.5).



2-4 Mountains representing the strength 2-5 Birds flying in triangle shape representing togetherness – Google Images

### Spiral

The spiral shape is the nature represents continuity and recursive as shown in the (Fig. 2-6).

Also, the golden ratio is derived from nature forming the perfect composition that any design

from science to design can follow. The golden ratio is the sides of the rectangle which when a square is cut off, the rest of the rectangle has same proportion of the original rectangle. The value of this ratio is Phi calculated as 1.618 considered as nature's perfect number. In nature, golden ratio proves that beauty likes in symmetric and balance of the design. Here the question is – How humans collectively have an emotional connection towards shapes of the nature?

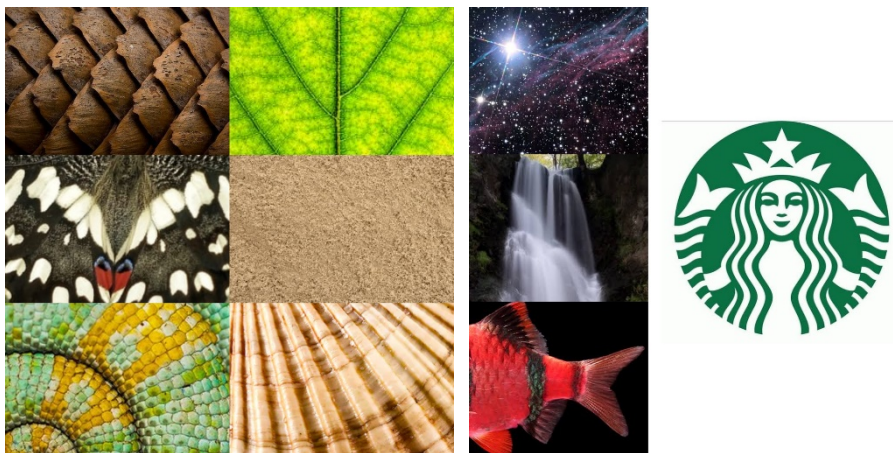


2-6 Spiral shape represents continuity 2-7 Golden ratio in nature  
– Google Images

### Patterns and textures

Every design is self-contained of a pattern that adds additional purpose to the design. Nature has countless patterns that one can get inspired from. These patterns can be explained differently in mathematics, physics and chemistry. There have been many theories derived from nature, the golden ratio is one such theory which is discussed in the following chapter. The patterns in the nature are majorly classified into symmetry, trees, fractals, spiral, flow, waves, bubbles, foam, cracks spots and stripes and these patterns are well composed and striking (Fig. 2-8). The following is an example of Starbucks logo (Fig. 2-9) to examine the pattern - the flow pattern of the waterfall and the composition of the fish tail as hands makes the logo perfect with equilibrium. Taking it further, it is necessary to examine the patterns in

the nature and application of it, to create equilibrium in the design. Similar to the patterns in nature, the textures adds depth to the design, the human creative brain has the ability to preserve and feel the two dimensional object and textures similar to the three dimensional surface. For example – considering the Minute maid pulpy juice, the bottle is mimicked with the texture of real orange fruit, which makes the consumer to trust that the pulp used is indigenous. In the (Fig.2-10) the signifier is the texture of the orange fruit and it is signified that the notion the pulp is original. There are many examples in our everyday life that are bio mimicked from the natural textures that will have an impact on the users – From plastic flower pots to mobile back case covers (Fig. 2-11). It is interesting to know the experience and impact on the consumer with these textures used on the products.



2-8 Patterns from the nature

2-9 Examining the Starbucks logo



2-10 Signifier and signified of Minute maid



2-11 Mobile cases with natural textures – Google Images

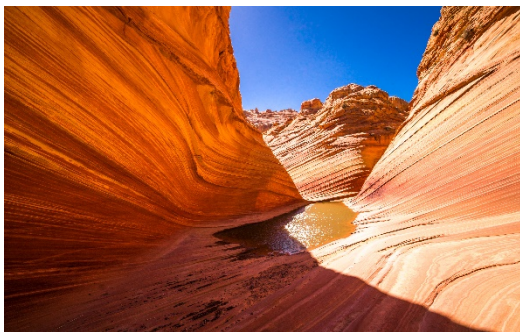


## Colours

Why are colours differentiated as warm and cool colours? To answer this question it is important to understand the nature and its colours. Colour gives meaning to the design, they change the mood of the person. To understand the often used term – warm and cool colour the following experiment is conducted with the hypotheses – The light and temperature decide the categories of the colour. Here the light is the natural agent that helps to see and the temperature is the degree of the heat. The question to ponder here is – Does the persuasion of the colour change with the change of the season?

### **Brown**

From the following (Fig 2-14) the colour brown is considered as warm and dry colour because of the high temperature.



*2-12 warm colour of the mountains*



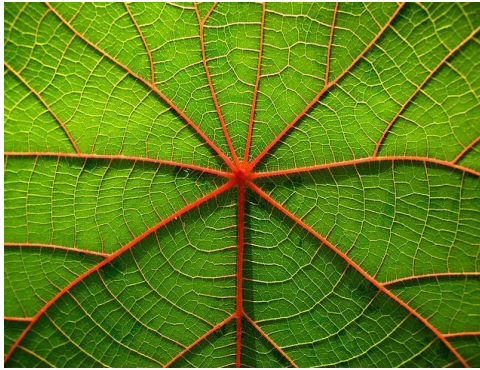
*2-13 Sand in the desert*



*2-14 Dried plants*

## Green

The colour green in the nature can be considered as warm and refreshing colour, this notion of considering green as refreshing might be the effect of the green pigment in leaves and their very nature of fresh feeling (Fig 2-15, 2-16)



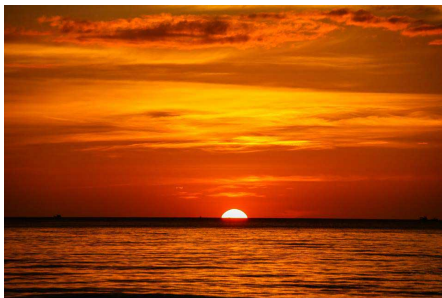
*2-15 Green leaf with organ vein  
– Google Images*



*2-16 A green bug as example of warm colour*

## Orange and yellow

The colours orange and yellow are bright and this can be seen as sun light and sunset they create a warm and pleasant feeling (Fig 2-17).



*2-17 Sunset as an example of warm colour – Google Images*

## Blue

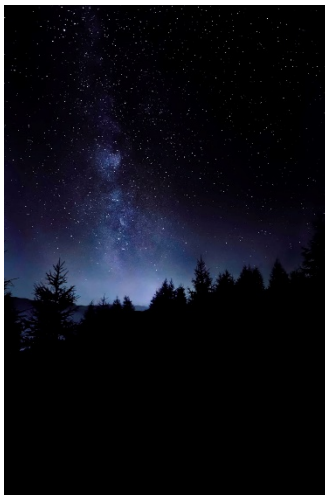
The colour of the water and the colour of coldness is considered to be cool because of its cold temperature.



*2-18 Blue colour of the ocean is considered as cool – Google Images*

## **Black**

The temperature gradually drops down in the night and also the colour of the sky black is considered to be a cool colour.

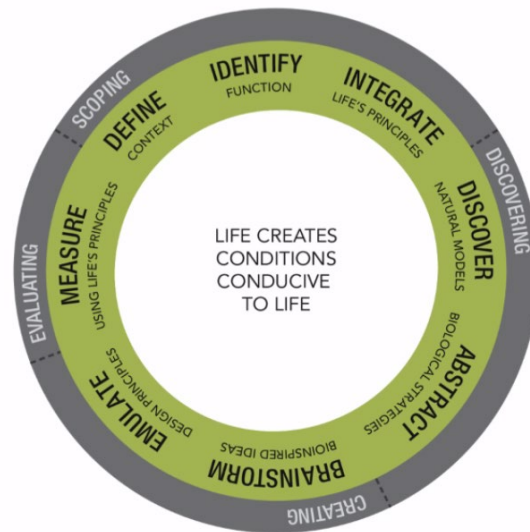


*2-19 colour of night sky - Pinterest*

## Bio-Inspiration and Biomimicry

Nature has been a constant inspiration, there have been many terms used to describe the process and products made with the help of nature as an inspiration. The term bio here refers to biological structures or processes, the design that inspired only from the form of is it called as biomorphic where are the mimicking of the nature is called as biomimicry. This inspiration is not only limited to the design but nature has been helping the humans by giving inputs in different fields like politics and social behaviour. To elaborate this, let's take the example of the ants, if closely observed the way the ants communicate and the way they lead to achieve

their goal can inspire one to understand and learn from them. There are various examples of biomimicry such as the aeroplanes inspired from the bird wings, and the bullet trains in Japan mimicking the shape of it to control the sound and speed of the trains. Also, the materials, devices and structures developed with nature as inspiration, are considered to be sustainable and self-sufficient.

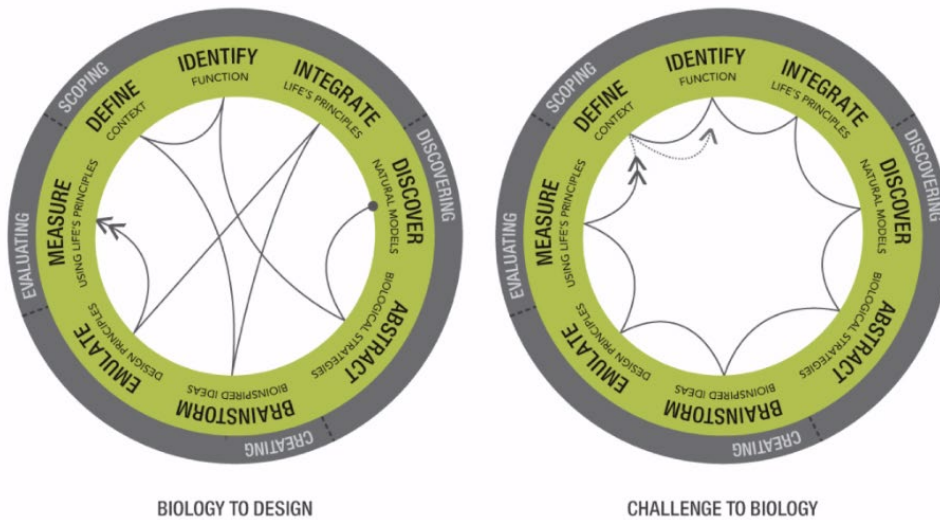


2-20 Biomimicry thinking - Biomimicry.net

The following (Fig. 2-20) is the Biomimicry thinking cycle suggested by Biomimicry 3.8<sup>7</sup>, the process of bio-mimicking consist of four phases namely Scoping, Discovering, Creating and Evaluating. The key ways for this process can vary as show in (Fig. 2-21) to go from finding an inspiration from biology and to design or to identify the challenge and to examine biology for inspiration.

<sup>7</sup> Biomimicry 3.8 on Biomimicry Thinking, (accessed November 08,2019), <https://biomimicry.net/>





2-21 Way for Biomimicry thinking - *Biomimicry.net*

The process of bio-mimicking has the following phases discussed in detail –

1. Defining the context to apply bio-mimicry design
2. Identifying the Function of the design
3. Integrating the Life's principles to emphasize the design (Example: Evolve to survive, adapt to changing conditions).
4. Discover the Nature's models that might be emulated
  - a. Micro
  - b. Meso
  - c. Macro
5. Abstract by choosing the application level to emulate the design
  - a. Literal
  - b. Metaphorical
6. Understanding the Nature's technologies to questioning what type of biological strategy to emulate
  - a. Form – Physical structure
  - b. Process – How the biology is happening
  - c. System – How is it fit in larger system

## Chapter 3: Emerging technologies

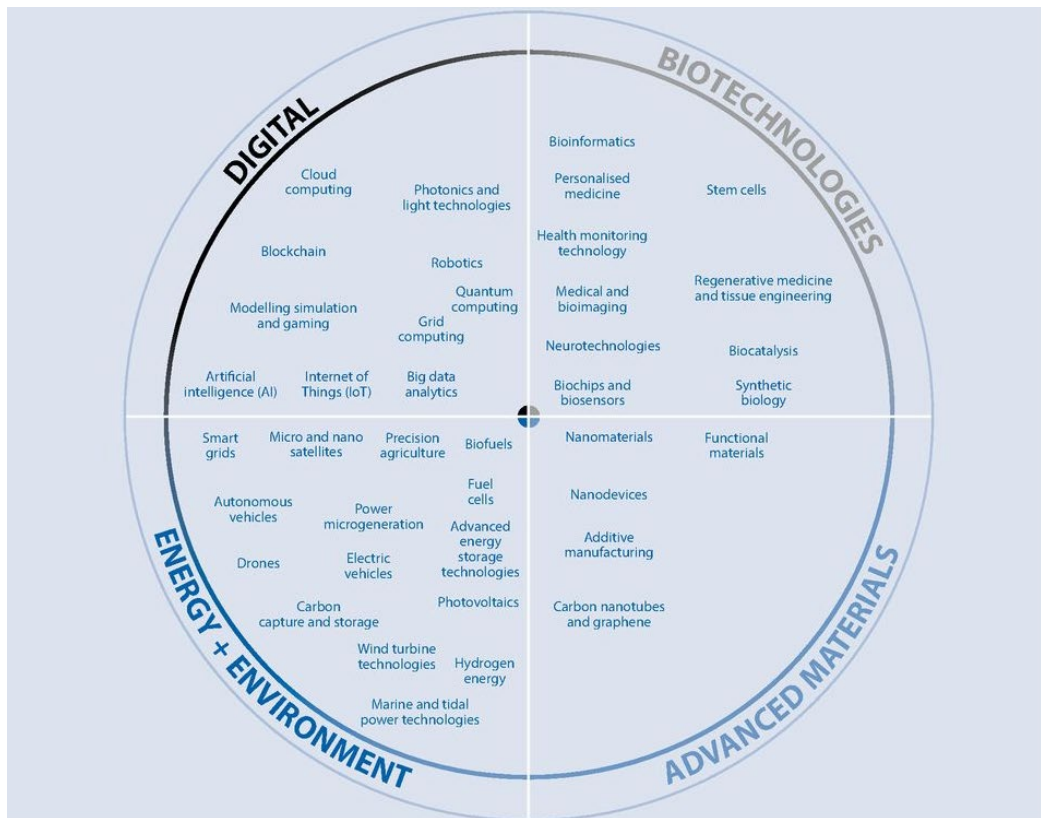
The recent digital and mobile revolution are a minor blip compared to the next wave of technological changes, as everything from robot swarms to skin top embeddable computers and bio printable organs start appearing in coming years (Follett, 2015). The Internet of Things (IoT), advanced robotics and 3d printing are going to be the next technologies, as a designer it is necessary to understand these technologies to predict how the future is going to be shaped and how these technologies can be applied to the real world problems.

The IoT, connected environment and wearable technology are going to be the next biggest things, there have been movies and series like Black Mirror on Netflix showing us the insights of the future technologies. These technologies are communicate machine to machine forming a strong interconnected network. According to the Cisco report the IoT is going change everything including our lives, there are going to be 50 billion devices objects by the year 2020.

According to the predictions of the emerging technologies the sensors on our bodies are going to be the tools for self-monitoring. Similar to the current obsession of the smartphones in the coming years the wearables are going to the next thing. If we consider this there should be a major attention in understanding how new software, internal structures and the interface designs and other multiple layers need to be designed.

The wearables are creating a massive new market in healthcare, fitness, wellness, fashion, entertainment, transportation, education, finance and etc. transforming the way people behave and interact with the environment. Today the wearable devices can be embedded in the watches, glasses to the clothes a person is wearing and within the person too. The embedded technologies can play with the sense as explained in the book (Follett, 2015), the human can

visualize the interface with the eye ball, the choice of the food can be customized according to the taste and the keyboard can be reimaged in the finger tips.

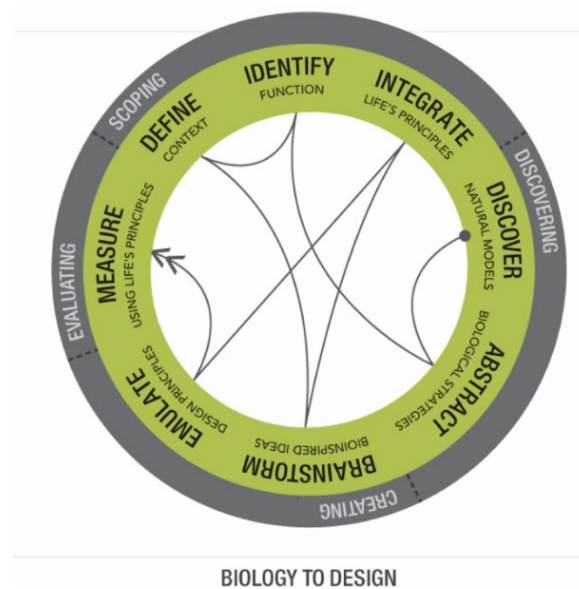


### 3-1 Key emerging technologies

With these emerging technologies, it is required to understand how people change their habits accordingly and the design should be proposed keeping in context the actor (person who uses it), surrounding, the device itself, context of use and relationship with other devices.

## Chapter 4: Proposed system

There is a necessitate proposing a system to eradicate child abduction, as discussed in the previous chapters. The following analysis and proposal are based on the context - nature as design inspiration. As per the guidelines from Biomimicry 3.8 the design proposal is going to be an inspiration from biology to design for the challenge.



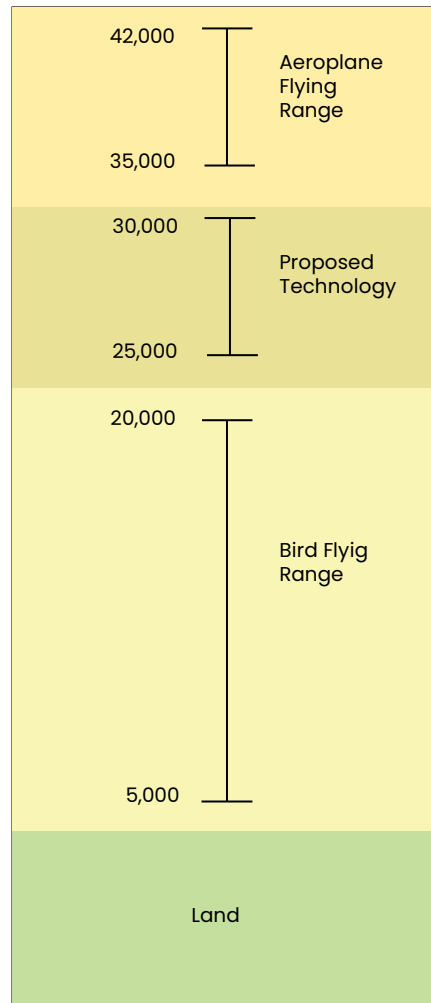
*4-1 Biomimicry design process*

**Discovery:** Reimagining surveillance by understanding how birds detect the food

The common trait all the birds poses is the excellent eyesight, which allows them to see the food from potential distance. All the birds of prey have acute vision to find food either flying or preched somewhere. Once the target is spotted, the bird will plunge down and snatch up the usually unsuspecting animal and carry it off<sup>8</sup>, this can be taken as an inspiration to reimagining surveillance. Just like the drones with cameras, there can be new devices designed which can be layered to the height above the bird fly range and monitor the surrounding on

<sup>8</sup> Sciencing.com on "How do birds find food?", (accessed November 11,2019), <https://sciencing.com/birds-find-food-4899132.html>

the land. According to the BirdNote maximum high a bird can fly is 5,000 feet to 20,000 feet and the aeroplane engine can fly in the range of 35,000 to 42,000. Thus considering these it can be assumed that this new device can fly in the range of 25,000 to 30,000 keeping an eye on the land.



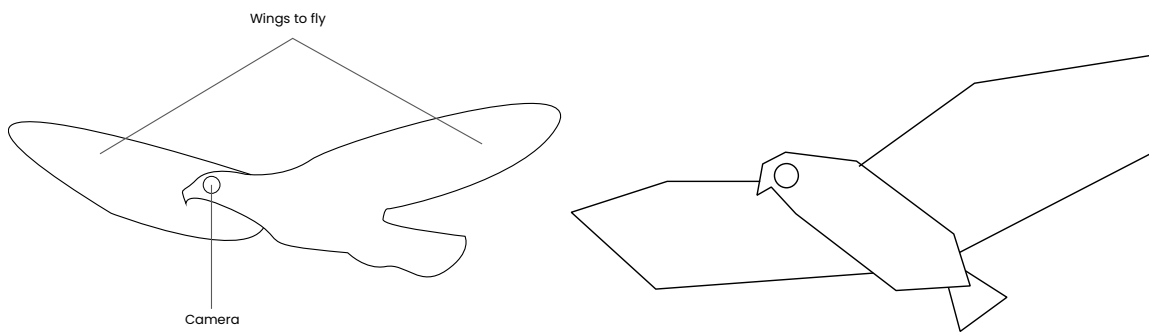
*4-2 Fly range of the proposed system - author*

The Eagle's eyesight is estimated at 4 to 8 times stronger than that of average human and it is said to be able to spot a rabbit 3.2 km away. Although an eagle may only weigh 10 pounds (4.5 kg), its eyes are roughly the same size as those of a human. As the eagle descends from the sky to attack its prey, the muscles in the eyes continuously adjust the curvature of the eyeballs to maintain sharp focus and accurate perception throughout the approach and attack (Grambo, 1999).



4-4 Screenshot of 360 view of Eagle view - Youtube

From the (Fig. 4-4) ‘Exploring the Dolomites from an Eagle’s Point of View in 360’<sup>9</sup>, it can be experienced how an eagle’s can be. In a similar way designing the flying surveillance system similar to the eagle.

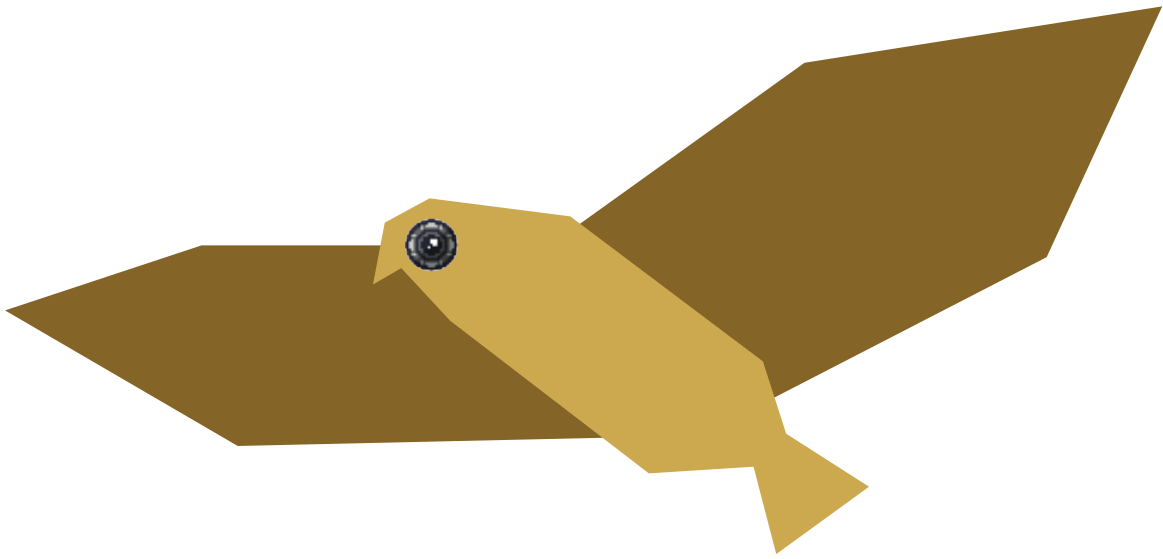


The above figures are the abstraction of eagle and its eye ball for the proposed flying surveillance.

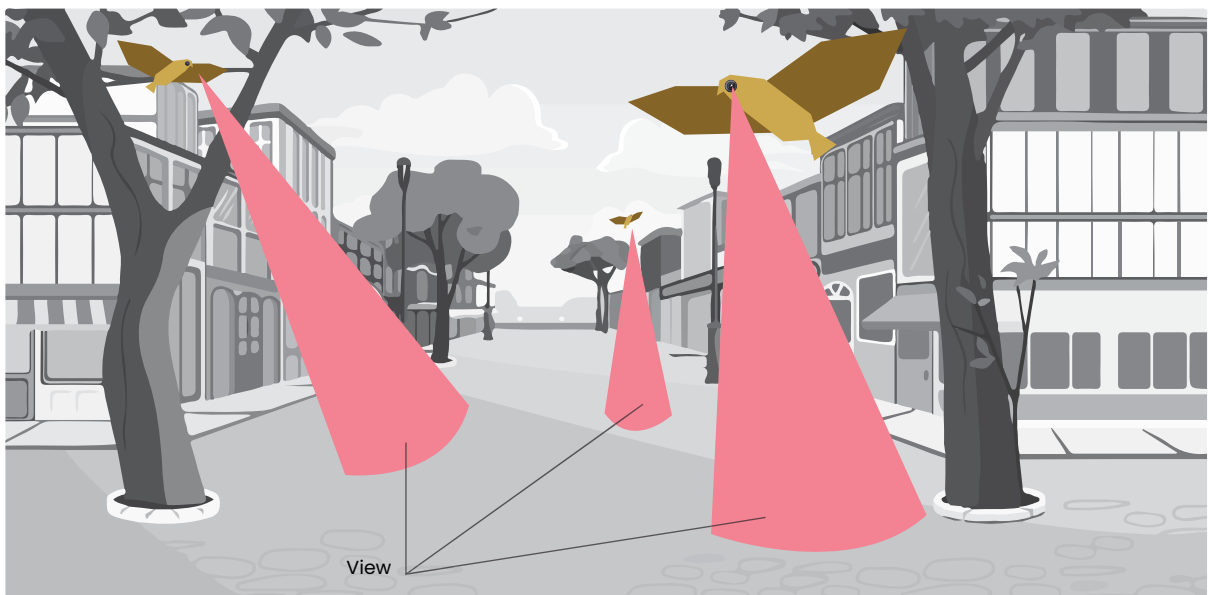
These devices should be able to detect LED light specifically programmed to be identified. And As the LED is identified the surveillance camera should be activated.

<sup>9</sup> Youtube.com on Exploring the Dolomites from an Eagle’s Point of View in 360, (accessed November 12, 2019) <https://www.youtube.com/watch?v=7E3XcO9DozY>

The context for this biomimicry is to act as a flying surveillance and be activated only in emergency situations. The function to be mimicked is vision of the eagle to identify the emergency situation and this level of mimicking can be said as literal to emulate the biological strategy by understanding the form of the bird, process to catch the prey and the system it's integrated in.



*4-5 Conceptual flying camera for surveillance*



*4-6 Conceptual flying surveillance on the streets*



In the context of child abduction in India, let's consider that in the coming years the government might take an initiative to make sure every child has the band to hand that can track their safety. This wearable can track and alert the crime team about the incident to take an immediate action while keeping the child safe.

**Actor:** The crime branch controlling the wearable on the child.

**Surroundings:** The surroundings can be the outdoor locations where most of the child kidnapping is recorded.

**Device:** The device here is the band that is mandatory for every child from the Age of 6 to 18 years old to be worn.

**Context of use:** For the safety of the child from getting abducted.

**Features:** A heartbeat calculator that alerts in case of unseal and notifies to confirm if it's an emergency situation.

**Relationship with other device:** This wearable device notifies the flying surveillance and in turn the crime team is alerted to take an immediate action.

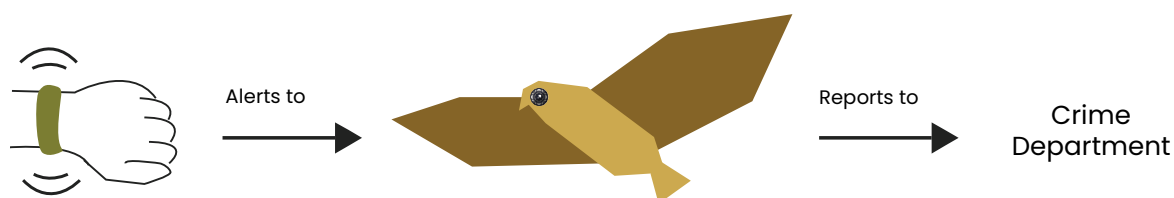
Factor	Design of the wearable
Visibility	Visible to others
Role	Tracker
Display-on-device	Minimal output display (LED- based)
Interaction model	Multimodal interaction:  Visual : Display of the LED light  Audio: Voice and Sound to communicate  Tactile: Vibrate to confirm to send alert  Physical Key: Button to alert





4-7 Illustration reimagining the surveillance to eradicate child abduction

The (Fig. 4-7) shows the proposed system with emerging technology of IoT that connects the band worn by the child, the band alerts the flying surveillance in danger informing the crime team of that particular location.



Every system has its own limitations which can be upgraded after the initial version, this system need to be rethought when considering the child abduction indoor. Taking the constrain to be surveillance in outdoor and imagining the world to be driven by technology in the near future, this idea and proposed system can act for the betterment of people's lives.

## Chapter 5: Conclusion

Gaining inspiration from nature guarantees in solving the world's technological problems and environmental problems simultaneously. After questioning and applying biomimicry design to today's problem, it can be concluded as the next emerging technology in the coming years moving the society towards safety and security. As a designers it necessary to challenge one self and to push the boundaries to be the next generation engineers and questioning oneself 'How do I vision the future world to be designed and how is it going to be reimaged with the new wave of technologies?'

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