Understanding Kid's Digital Twin

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Abstract- *Childhood is the most important part of everyone life as it shapes fundamentals of their identity and characteristic. The better lifestyle during their childhood, the better generation will be presented for future. Nowadays, for every physical asset in the world, we could have a virtual cloud base copy running that gets richer with every second of operational data. Practically, opportunities are uncovered within the virtual environment that can be applied to the physical world by applying "Digital Twin" concept. The purpose of this paper is to investigate the relation of virtual reality's potential in kid's development progress via introducing "Digital Twin" for kids. It could be the optimum approach that we begin to recognize children through his/her individual digital twin based on dynamic profiling.*

We propose that the idea of the Digital Twin, which links the physical and mental issues of the kids with its virtual equivalent can assist parents to mitigate problematic concerns. We describe the Digital Twin concept and its development and show how it applies to kids' development progress in defining and understanding their behavior. This paper discuss how the Digital Twin relates to kids' character and how it addresses parents impact on "kids character".

Keywords: Digital twin, Dynamic Database, Kid's Development Progress, Integrated Digital Identity, Virtual and Real-word Synchronization, Virtual Behavior Analysis, Real-Time Behavioral Fata, IoT

1 Introduction

The world of technology has massively changed over the last decade and it runs our lives these days. Each new upgrade technology compounds existing technologies to create something better than what was previously used before. And on and on it goes. Obviously, the technology trend has this capability to help parents in order to more unified and integrated understanding of their kid's character and intensity.

It has been tried to construct an integrated discourse how to understand kids by developing and understanding their "Digital Twin". In a sense, this attempt appears in this way, first, the digital data reflecting the lifestyle of the kids that are uploaded by parents to gather data about real-time statuses which are bound in a unified identity of the kid. The basic data are connected to a cloud-based system that receives and processes all the data that parents monitor. This input is analyzed against the best customized and personalized lifestyle and make an individual growth strategy roadmap for kids and it will improve parent skills by improving their awareness about their educational and parental approach to their kids. Indeed, through learning and exchange of spatiotemporal data with the parents, enabled through interfaces connecting us to virtual reality such as the Internet of Things (IoT), mobile apps and smart wares. By Digital Twin of the kid becomes smarter over time, able to provide

predictive insights into the better potential lifestyle and growth.

Fig. 1. Digital twin technology is the bridge between the physical and digital world © www.gestion.pe

2 Understanding our true kid, Validity of Resources

Parenting patterns are passed from one generation to the next over time and each decade has its own challenges. Indeed, nowadays children have a different lifestyle in comparison with the previous generation that their parents have grown up that evolutionary change also applies in the parenting style as deemed necessary to this change. In fact, parents always endeavor to be updated on how to treat their kids and always provide them with proper education that suits their kids' age and physical/psychological characteristic. Psychiatrist, child development specialists as well as all other accessible resources such as internet, books and etc are all there for parents for reference. But as much as all these resources are available for parents to refer to, they are also generic in nature and not necessarily related to each child individually and though they are missing unique milestones in every kids' physical and behavioral progress. Ignoring the fact that environment -in both physical and nonmaterial from of it- shapes the fundamentals of most parameters impacting kid's development, would result in the partial and non-comprehensive understanding of required informative resources for parents. In this case, a smart platform can assist parents with their own kids' personal physical and behavioral development progress recognition and profiling.

It is necessary to make parents aware of the parameters that could be true representatives of their kids' identity and why it is important to have these parameters into consideration when it comes to shaping valid and real-time resource to kid's development. Above mentioned virtual platform would role as a valid resource for kids' development progress and would demonstrate the very same nature of the kids' development progress itself. It would be real-time, responsive and dynamic in nature.

3 Environmental Impact

Kids' development progress is directly/indirectly impacted by environmental elements. These elements could influence and define kids' development progress pattern such as physical, social and emotional skills, and thinking/mental abilities. Understanding dynamic multi faced nature of kids' environment could be of as importance in creating a proper roadmap that raise awareness to milestones in development progress process. Physical environment and non-material environment including emotional and social environments are to be considered in the process.

3.1. Physical Environment

Kids are surrounded by physical environment and their development are directly/indirectly impacted by the quality of this physical space. Potentially any change to physical environment could lead to a change in kids' development progress and thus should be carefully monitored and recorded to kids' favor. Monitored element could include incidents, crime, and environmental physical pollution (i.e. air, water and noise). The importance of physical environment would be even more significant when it comes to development progress for kids with disabilities (physical and mental) as it also defines the barriers that are in place to utilize physical space to its maximum potential. Element such as accessibility to vehicles, pedestrians, and entry of buildings will become subjects of attention which needs to be carefully reviewed and addressed.

However, there are also other issues which effect on the kid's physical development. For instance, entertainment technology (TV, Internet, video games, iPads, and cell phones) has advanced on such exponential rate that researchers have scarcely noticed the significant impact and changes to the development progress. Technological entertainment will effect on the physical well-being of kids which will be caused Obesity, Inefficient Sleep Pattern, Repetitive Strain Injuries, and laziness and lower health index in general.

3.2 Non-Physical Environment

Humans are categorized amongst most complex systems. Every individual has a single dynamic behavioral pattern and its own character. “From this perspective, there can be no character “Types” since every person’s array of organizing principles is unique and singular, a product of his or her unique life history.” [1] As for kids, interests, tendency, and character are even more dynamic and over time it would be changed rapidly. Therefore, each kid would have its own mental status that is influenced by “traffic, noise pollution, crime and other hazards which all are issues that affect children’s everyday freedoms.” [2] These could be considered non-material environmental parameters that has significant impact on kids’ development progress. Such concerns created a growing tendency for parent and guardians to shelter their kids in their safe zones, at home, where less environmental challenges are arising.

Understanding the impact of non-material environmental elements are not as easy as physical elements as they could be considered physical in materiality but could be categorized as non-material element in the nature of their impact. Elements such as color; “Color comes with a strong emotionally magnified impact for the kid which will bring out certain emotions in response. Color can define any space for kids and translate the hidden codes within that space in a clear emotional way, codes such as security, danger, dynamism, excitement and etc.

Utilizing of proper colors while considering the existing depth of space can emotionally bring out both positive and negative potentials of an urban space for kids. For instance, while green can point out a stress-free environment, red will express a dynamic one, or using yellow and black colors beside each other will point out a potential hazard in an environment.” [3] And thus a chaotic color disorder in environment could be considered as an environmental element with negative impact on kids’ development progress.

In order to identify these possible environmental elements a dynamic smart and personalized platform/database is required that could both receive real-time data from kids’ development and also to render an equivalent system, dynamic in nature which is synced with kids’ development progress and is a true representative of that. Defining such platform/database can improve parents’ awareness about child’s physical, psychological and behavioral health and improve kids’ ability to learn and sustain personal and family relationships as they are indispensable in nature. Nevertheless, “success of such transformation requires the ability to understand and manage new challenges that emerge in time and space over time”. [4]

4 Digital Twin

Creating real-time virtual identities with complex and meaningful behavioral patterns has become possible thanks to significant advances in machine learning protocoles, smart algorithms and AI along with cloud base data collection and cloud processing. [5]

The term Digital Twin was brought to the general public for the first time in Shaftoetal.(2010)and Shaftoetal.(2012).[6],[7] Digital twin technology is the bridge between the physical and digital world. It is a virtual model of a process, product or service. This pairing of the virtual and physical worlds allows analysis of data and monitoring of systems to head off problems before they even occur, prevent downtime, develop new opportunities and even plan for the future by using real-time and smart simulations. “The concept of the digital twin is mostly associated with the model-driven virtual image of a real system. Through a model, which emulates certain functions of the real system, predictions of can be estimated and analyzes can be performed”. [8]

Such digital twin synchronizes its status with the real object through sensors and communication interfaces. It can directly affect the real system, for example through the modification of parameters or it can be used as a communication interface to other systems and also to humans, for example in order to observe a certain status. [9]

Understanding digital twin of a system is much easier than understanding same system directly, as one can identify and analyze key parameters one at a time and also in relation together. Smart and dynamic equations would also enable us to predict and visualize the strange attractor of that system’s behavioral pattern. Merging digital twin concept with psychological cognitive science will allow us to use the concept of digital twin in kids’ development progress. Following topics will discuss how digital twin concept can be utilized and implemented to create a comprehensive roadmap for kids’ development progress. [10]

4.1 Digital Twin platform

Due to nature of kids’ development, we would be talking about an integration of various informative virtual models. Every one of these models covers a certain scope of kids’ development progress. The digital twin would be defined by informative interaction of these virtual models on a single platform. These model could include Geographic Information System (GIS) models, Virtual physical/psychological development progress

models, Environmental data (i.e. police incident, crime... data). Kids' digital twin would be a real-time platform role as the interface of above mentioned models. This platform is a unified Application Programming Interface (API) that runs as an interaction hub for environmental and informational APIs.

4.2 Digital Twin Data Input

Supported by real-time data collection from kid's behavioral pattern, physical status and biometrics, a Big Data would be shaped as analyzed computationally data-set reviling behavioral and physical development patterns. The input data collected here is interpreted by the interaction of machine learning and AI algorithms and through the unified platform.

4.2.1 Database

In order to convert and transit physical environment to virtual environment, two types of the database are needed, A customized "kid profiling" and "general" database.

Kid profiling database contains personal data which are collected from parents of their kid like age, gender, nationality, lifestyle (i.e. parents schedule and budget), cultural values, disability (physical and mental), allergy and etc.

General database is a data collected from context (i.e. authorities) and contains general data type such as GIS, accessibility (vehicles, pedestrians), depth of perceptible space, density, visual disorder, environmental pollution (i.e. air, noise), climate, incident, crime, green and public spaces, and etc.

Access to a real-time database is toward ''Internet of Things'', which caused data become more accessible and ubiquitous that necessitates the right approach and tools to convert data into useful, actionable information [11].

4.3 Digital Twin Interface

The digital twin interface is also customized to create an open end dialog between its users (kids, parents, kids), a Human-Computer Interfaces (HCI) that is multi faced in nature but presenting a unified platform. The focus of the interface is the interaction between human and the virtual identity that is to be consistent, yet dynamic in nature. This interface would connect the kid and parents (guardians) to his/her associated digital twin.

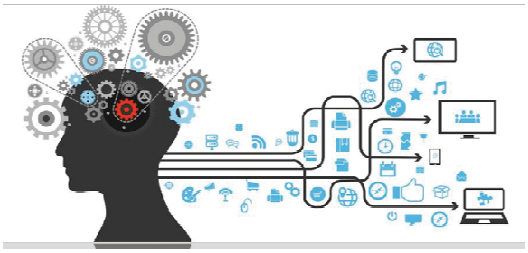

Fig. 2. Kid's profiling database is a real-time and dynamic database © www.fomentformacio.com

5 Methodology

This work aims to introduce a roadmap to a methodology that allows the construction of the platform for information Exchange-Digital Twin-. The main idea of this proposal is to model a digital twin of kids' physical and mental development at a high level. This model of platform is a base to exchange information with other APIs as well as users, complicated enough for APIs to shape their interaction and user friendly enough to shape a dialog with users.

Fig. 3. Different dimensions when using simulation technology (Digital Twin) throughout the entire life-cycle of a system [16]. It was illustrated the schematic of Kid's Digital Twin based on current life prediction process.

The emergence of Digital Twins [14], [15], [16], an endeavor to create intelligent adaptive machines by generating a parallel virtual version of the system along with the connectivity and analytical capabilities enabled by IoT, constitutes the foundation for cognitive development of ideal lifestyle for the kid. An Artificial Intelligence system will harvest informational data which was made by kid's physical and physical character and also the experimental context created by other associated users. Over time an individual growth strategy roadmap of the kid is formed. The system is being analyzed consistently and the real-time platform would shape the dialog with users through its user friendly interface.

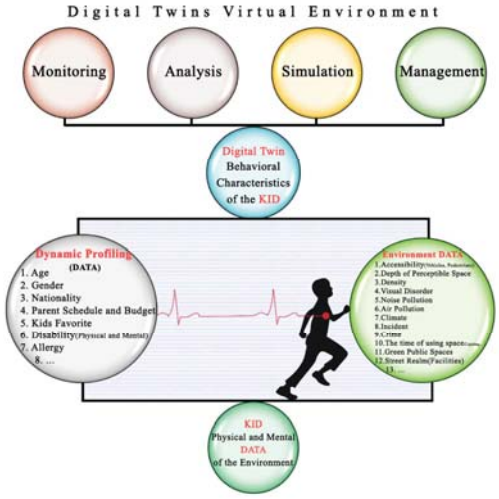

Fig. 4. Schematic of constructing the digital-twins virtual environment of KID integrated with "Dynamic Profiling Data" and "Environment information fusion.

The digital twin of every single kid's character, cognizant of the profiling data and basic data, and their fluctuations in time and space, is progressively able to anticipate the strange attractor of behavior and character in the systems and predict possible/optimum future behaviors. The predictive conduct of the digital twin character relies on the real-time kid dynamic profiling and general data. Additionally, irrespective of the current basic character, a digital twin character can simulate what-if current kids' lifestyle is not efficient or ideal and how it can improve to an optimum one.

6 Conclusion and Further Works

Kid-character-technology interactions, in which dynamic profiling of kid is integrated into an analytics platform, may enhance the quality of kid lifestyle. The Kid Digital Twin represents a first step toward developing a reality-virtually system at the real-time intersection of these interactions. This material is based upon work supported by Morphotect Design Group's R&D Department which is focused on protocols and interfaces of kid that have potential to merge Digital Twin to physical(real) world of him/her. Future research can expand this framework in ways that enable the complex interdependent visual and numerical analytics that will allow how parents can understand all aspects of Kid-character-technology interactions to achieve resilience objectives.

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