Smart Innovation, Systems and Technologies 233

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Ana Claudia Mendes de Seixas ·
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Proceedings of the 6th Brazilian Technology Symposium (BTSym'20)

Emerging Trends and Challenges in Technology

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Foreword

With great satisfaction, I write this Foreword for the Proceedings of the 6th Brazilian Technology Symposium – Emerging Trends and Challenges in Technology (BTSym'20), held virtually, for the first time, at the PUC Campinas University, Brazil, in October 2020 and the UPC University, Peru, in December 2020. This event is in its sixth edition and has consolidated to become an excellent opportunity for researchers, professors, and students to present and discuss the results of their research works.

In the 2020 edition, the BTSym activities could not be accomplished in person due to the Covid-19 pandemic. However, the event has been characterized since its first edition by the broad scope of the areas exposed and, within a virtual environment, it was possible to expand our network of researchers and encourage them to expose their papers, which deal with current and priority topics for Brazilian and world technological development, including subjects related to the various branches of innovation in industrial processes, robotics, telecommunications, buildings, urban infrastructure, product development, and biomedicines.

Events such as BTSym are an essential part of the research and innovation process. Firstly, these events contribute to the promotion of research activities, which are key to a country's technological development. The dissemination of research results, as promoted by BTSym, contributes to the transformation of research findings into technological innovation. In addition, these events facilitate the sharing of findings, leading eventually to the formulation of research networks, which accelerate the achievement of new results. Therefore, I would like to congratulate the BTSym General Chair, Prof. Dr. Yuzo Iano, and his group of collaborators for the important initiative of organizing the BTSym'20 and for providing the opportunity for authors to present their work to a wide audience

through this publication. Finally, I congratulate the authors for the high-quality work presented in these proceedings.

Alex Midwar Rodriguez Ruelas
Proceedings Chair of Brazilian
Technology Symposium

Preface

This book contains the Proceedings of the 6th Brazilian Technology Symposium – Emerging Trends and Challenges in Technology, held in Brazil in October 2020 and Peru in December 2020.

The Brazilian Technology Symposium is an excellent forum for presentations and discussions of the latest results of projects and development research in several areas of knowledge, in scientific and technological scope, including smart designs, sustainability, inclusion, future technologies, architecture and urbanism, computer science, information science, industrial design, aerospace engineering, agricultural engineering, biomedical engineering, civil engineering, control and automation engineering, production engineering, electrical engineering, chemical engineering, and probability and statistics.

This event seeks to bring together researchers, students, and professionals from the industrial and academic sectors, seeking to create and/or strengthen the linkages between issues of joint interest. Participants were invited to submit research papers with methodologies and results achieved in scientific level research projects, completion of course work for graduation, dissertations, and theses.

The 56 full chapters accepted for this book were selected from 267 submissions, and, in each case, the authors were guided by an experienced researcher with a rigorous peer-view process. Among the main topics covered in this book, we can highlight manufacturing processes, lean manufacturing, industrial costing models, sustainability and productivity, circular economy, workplace safety, control systems, Internet of Things, cyber-physical systems, Transportation Management System (TMS), logistic services analysis, digital supply chain, socio-economic impacts of technologies 4.0, robotics applications, artificial neural networks, Big Data, deep learning, computational vision, cybersecurity, soft-computing methodologies, technologies applied to cities development, smart cities, energy

sustainability, Building Information Modeling (BIM), environment analysis, technologies applied to health, biomedical innovations, socio-economic impacts of COVID-19, technologies applied to education, academic development, civil aviation studies, and much more.

We hope you enjoy and take advantage of this book and feel motivated to submit your papers, in the future, to Brazilian Technology Symposium.

Best wishes,
Gabriel Gomes de Oliveira
Technical Program and Finance Chair
of Brazilian Technology Symposium

Acknowledgements

Our appreciation goes to a lot of colleagues and friends who assisted in the development of this book, Proceedings of the 6th Brazilian Technology Symposium – Emerging Trends and Challenges in Technology (BTSym'20).

First of all, I would like to thank all the members of the Organizing and Executive Committee for the commitment throughout the year. Several meetings were held, and many challenges were overcome for the accomplishment of the BTSym 2020. Also, and with great merit, I would like to thank all the Scientific and Academic Committee and Technical Reviewers Committee members for their excellent work, which was essential to ensure the quality of our peer-review process, collaborating with the visibility and technical quality of the BTSym 2020.

The Brazilian Technology Symposium is an event created by the Laboratory of Visual Communications of the Faculty of Electrical and Computer Engineering of the University of Campinas (UNICAMP). In this way, I would like to thank the PUC Campinas and UPC Universities, especially for supporting and hosting the BTSym'20 and BTSym'20 Satellite, respectively, which was fundamental for the successful accomplishment of the events.

Finally, on behalf of Prof. Yuzo Iano, the General Chair of the Brazilian Technology Symposium, I thank all the authors for their participation in the BTSym'20; We sincerely hope to have provided a very useful and enriching experience in the personal and professional lives of everyone. Our special thanks go to Professors Ana Cláudia Seixas, Cláudia Cotrim Pezzuto, Guillermo Leopoldo Kemper Vásquez, and Carlos Raymundo Ibañes; Without their efficiency and hardworking, our events could not have been accomplished, so the BTSym'20 and BTSym'20 Satellite certainly have much to thank them.

Best wishes,
Gabriel Caumo Vaz
Institutional Relationship Chair
of Brazilian Technology Symposium

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Emerging Trends in Human Smart and Sustainable Future of Cities

Technology and Inclusive Education, Hybrid Web Application - Entertainment and Learning

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Abstract. Considering the present moment in the Brazilian society in which schools are legally required to accept all kinds of students, it has appeared opportunities for development and uplift of cases regarding the study of the web application's implementation focused on inclusive education in schools with the use of hybrid technology. They can be used in all kinds of disabilities in which computers and gadgets can be required or not, bringing satisfactory results to children's learning and entertainment.

Keywords: Accessibility · Education · Entertainment · Inclusion · Learning · Technology · Web application

1 Introduction

For many years during Brazilian and global history, several models and structures were created to integrate the education of disabled children in the society, but governments used to ignore inclusion questions. Until few years, it used to exist separated schools for children regarded as normal and, separately, special schools for disabled children with hearing impairment as well as physical, visual, mental, and even multiple disabilities [1].

However, the people's consciousness changed, new laws appeared, and questions rose, letting society change. Hence, inclusive education has appeared, breaking the existing segregated system and enclosing inclusive education into the regular school model. The main objective is the interaction and social integration of students with disabilities [2], as in Fig. 1.

The whole present scenario key point is the obligation in which schools must accept every student, regarded as normal or with disabilities, adapting the school environment, providing capacitation and proper training to its staff to be ready to all day to day activities [1], even existing several failures in the learning and entrainment of children with disabilities, people considering the implementation of a web application.

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Fig. 1. Illustration showing an example of integration and coexistence of students with disabilities [2].

2 Methodology

The hybrid applications are developed in web technology, using, in most cases, programming languages such as HTML5 [3], CSS3 [4] and JavaScript [5], which are based in web view systems, part of Google Chrome technology that allows apps to exhibit web content besides of the aggregation of several advantages such as the facility and agility in the development, use of the same code to several platforms, simple and common maintenance to all the creation platforms and wide variety of available plug-ins in the market.

Scientifically established, the use of technology with disabled children is an effective way of achieving progress in treatments and providing entertainment as doing new activities, the brain may present a better performance in its abilities, improving difficulties. That said, hybrid applications considered several disabilities to entertain and teach towards digital games, answers, questions, children's stories, music, and several other activities, the most appropriate individually considered to each disability [2, 6].

As previously mentioned, the following details of the different kind of disabilities will be explained below:

2.1 Visual

The visual impairment refers to an irreversible situation in which the visual response is reduced by congenital or hereditary causes, even after clinical or surgical treatment or the use of ordinary glasses [7]. According to the WHO - World Health Organization, the impairment degrees are classified as one of the following possibilities:

1. Low Sight (mild, moderate or severe): Stage in which can be used auxiliary instruments, such as glasses, contact lens, magnifiers, canes, and location training;
2. Near Blindness: Stage in which distinguishing shade and light is still possible, but where braille, audio description, and canes may be used as well as location and mobility training;
3. Blindness: Stage in which there is no light perception, where braille, canes as well as location and mobility training are mandatory;

2.2 Hearing

The hearing impairment is defined as the difference between an individual's performance and the normal hearing ability established by ANSI - American National Standards Institute [8]. Generally, a normal audition refers to the normal capacity of detecting sounds up to 20dB [7]. The hearing impairments can be categorized in the following cases:

1. Above 0 to 24 dB - Normal hearing;
2. Above 25 to 40 dB - Mild hearing impairment (mild deafness);
3. Above 41 to 55 dB - Moderate hearing impairment (moderate deafness);
4. Above 56 to 70 dB - Pronounced hearing impairment (pronounced deafness);
5. Above 71 to 90 dB - Severe hearing impairment (severe deafness);
6. Above 91 dB - Profound hearing impairment (profound deafness);
7. Anacusis (complete deafness);

2.3 Mental

Mental impairment is a term used to define brain disorders that compromise cognitive functions. The children with the mentioned impairment present intellectual function patterns below the normality, featuring IQ scores below 70, which led to difficulties in their adaptive behavior [7]. Those scores can be divided into four other sub-categories:

1. F 70 - Mild Mental impairment (IQ 50 till 69);
2. F 71 - Moderate Mental Impairment (IQ 36 till 49);
3. F 72 - Severe Mental Impairment (IQ 20 till 35);
4. F 73 - Profound Mental Impairment (IQ below 20).

2.4 Physical

Physical impairment is a term used to define the limitation in mobility or general motor coordination. There can be several origins for it, e.g., neurological or neuromuscular disorders, congenital malformation, or acquired characteristics such as hydrocephaly (fluid accumulation in the cranial box) or cerebral palsy [7].

The children with this kind of impairment usually have difficulties in writing, as motor coordination may be affected. The learning in these cases may take longer than usual, but, except for severe brain injuries, language is acquired without major drawbacks [7].

The physical impairments may be classified into different categories, such as paraplegia (the motion loss in the lower limbs), tetraplegia (the motion loss of the four limbs), and hemiplegia (the motion loss in just one body hemisphere). Other classifications may apply in cases such as amputations, cerebral palsy, and ostomy (abdominal opening for feeding inlets use) [7].