

# IRIS: An Interactive Video Game for Children with Long-Term Illness in Hospitals

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**Abstract**—Information technology has long served the needs of individuals for learning and entertainment, but much less for children in sickness. The aim of the proposed online video game is to provide immersive learning opportunities as well as essential social and emotional scenarios for hospital-bound children with long-term illness. Online self-paced courses on chosen school subjects, including specialized software and multisensory assessments, aim at enhancing children's academic achievement and sense of inclusion, while doctor minigames familiarize and educate young patients on their medical conditions. Online ethical dilemmas will offer children opportunities to contemplate on the importance of medical procedures and following assigned medication, often challenging for young patients; they will therefore reflect on their condition, re-evaluate their perceptions about hospitalization, and assume greater personal responsibility for their progress. Children's emotional and psychosocial needs are addressed by engaging in social conventions, such as interactive, daily, collaborative mini games with other hospitalized peers, like virtual competitive sports games, weekly group psychodrama sessions, and online birthday parties or sleepovers. Social bonding is also fostered by having a virtual pet to interact with and take care of, as well as a virtual nurse to discuss and reflect on the mood of the day, engage in constructive dialogue and perspective-taking, and offer reminders. Access to the platform will be available throughout the day depending on the patient's health status. The program is designed to minimize escapism and feelings of exclusion and can flexibly be adapted to offer post-treatment and a support online system at home.

**Keywords**—Hospitalized children, interactive games, long-term illness, cognitive enhancement, socioemotional development.

## I. INTRODUCTION

IN order to understand the importance of the hospital environment toward serving the needs of its younger patients, one may look towards health-promoting hospitals (HPH) that prioritize children's normal developmental needs and empower children patients to deal with issues of their health in beneficial ways [1]. There are numerous factors that influence children's healthy growth in the safety of a hospital, however the initial introduction of a long-term illness to a child's life may at first be a severe challenge, or otherwise styming their development [1]. We can separate these hospitalized children's needs according to when they surface, either in non-threatening or threatening situations. Children's needs for recognition, participation, information, new experiences, and activity would surface during non-threatening times like staying in their hospital room during normal treatment or surgical operations [2]. On the other hand, their needs for control, familiarity, integrity, and the parents' presence are most prominent in

threatening situations like when symptoms of their illness arise or when they are in pain.

More often than not, hospitalized children miss out on many of the experiences that the outside world has to offer. Whereas most children who do not suffer from debilitating or serious illness spend their free time as they please, for example, to freely play outside with their friends, the same is not true for the ones confined to a hospital room. Due to medical conditions that require constant attention like cancer, tuberculosis, respiratory and heart disease, young patients must often remain on their hospital bed for endless hours with nothing but a television, screen time on their mobile phones, drawing books, or however else the nursing staff can alleviate their loneliness and boredom. Being hospitalized means these children are under careful observation, maintenance, and care by nursing staff, often over long periods of time that span weeks, months, and in some rare cases, years. Being restricted to the hospital environment for such lengthy periods can have long-term cognitive and socioemotional consequences.

Optimal care for children in hospitals should meet these many needs sufficiently, in a home-like environment that also acts as their catalyst for information, entertainment and comfort [2]. Their need to be informed ties into their need for school learning, as well as how they may understand their illness and hopefully come to terms with it in a healthy way. For this to happen, the relationship between the catalyst (in this case, the hospital staff that tend to them) and the child patient should be characterized by the candid sharing of information between nurse/doctors and patient. Providing hospitalized children with adequate schooling throughout their stay may aid their knowledge retention prior to their hospitalization, and being exposed to school material outside of school may help them with information recall [3]. Also, having inadequate information on their state of health may lead to children developing fears and anxieties regarding themselves, and drawing inaccurate misconceptions about their illness [4], [5]. The challenging part becomes tailoring difficult explanations pertaining to their illness in a way that a child may understand [6], and in a manner that sates their need for information. Children's need for a parental presence is further accentuated during their initial hospitalization [7].

Providing young patients opportunities for social encounters, negotiation, and communication with other children is yet another challenge. Hospitalized children need to be socially connected and experience a sense of belonging and inclusion not only in one local community (e.g., the hospital) but also in

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larger social communities. Socializing and entertainment should be among the main objectives of any program while respecting diversity and accommodating different personalities, learning styles, and individual needs and skills of young patients [8].

The purpose of the present program is to address the above needs in a digital manner. More specifically, IRIS is an online game designed and created following recent theoretical foundations of learning through exposure to technology and gaming. The major areas addressed include the cognitive and socioemotional needs experienced by hospitalized children.

## II. IRIS: AN INTERACTIVE VIDEO GAME FOR CHILDREN WITH LONG-TERM ILLNESS IN HOSPITALS

### A. Cognitive and Moral Reasoning Learning Activities

IRIS includes several online activities aimed at enhancing young patients' cognitive skills. More specifically, the game is using many forms of media, like short videos and interactive mini-games, to help teach hospitalized children information that adheres to their school grade, whilst cultivating their knowledge on their medical condition. Furthermore, the virtual platform intends to advance children's critical thinking and moral decision-making skills.

#### Virtual School-Based Lessons

The need for academic progression and inclusion is of utmost importance during hospitalization. Treatment may take a long time but children's need for optimal learning conditions is not lessened; the domain of information technology has profoundly affected education so far and has addressed the requisite needs successfully [3]. As a virtual platform, IRIS intends to enrich hospitalized children's school-based knowledge. By taking in the information of the child's school grade during the avatar customization stage, IRIS can then gauge the type of school activities that are performed at that level, and the curriculum children of specific grades are supposed to know and learn, using specialized software, like MyStudyBar, CAI, and FlipGrid. IRIS contains a series of mini-games of increasing difficulty pertaining to school subjects. For English courses, for example, the session would offer practice exercises like matching words to their meanings and completing sentences using Text-To-Speech software, like Dragon Naturally Speaking. For Math, the child would be presented with simple and visually appealing math problems and fill-in-the-blanks exercises, using MATLAB. For Geography, they would be provided with a map and a prompt word of a country, then they would be asked to select the part of the map that it belongs to, using multi-sensory tools. As mentioned, these knowledge-building games will rise in difficulty the better the children do in them, to reflect a sense of progression over a period of time. Completing a stage would also unlock customization options for the players (e.g., tokens that they will get to spend on rewards like a famous statue bust of a historical figure from their History virtual classes, a map of the world from their Geography classes, and so on) to incentivize them to keep playing, as well as virtual field trips to museums, countries, or

famous monuments.

### Videos on Medical Condition and Moral Dilemmas

IRIS provides an effective platform for the child to learn more about their own condition by licensed professionals. Having a library of videos tailored to the hospitalized child's condition, which is specified during avatar creation, the video game encourages that the children explore and learn more about their illness, the importance of treatment procedures, the equipment used, and dealing with side effects. The videos would be easily digestible by all ages through the effective use of simple but medical explanations, given and created by specialized doctors in their respective fields. After each video has ended, there will be a small period of comprehension exercises (e.g., three multiple-choice questions regarding the discussed material) after which the children will be able to move onto more content.

IRIS will also foster young patients' moral reasoning by introducing them to important ethical dilemmas on receiving medical treatment or not, congruent with Kohlberg's *good-child morality* which emphasizes socially accepted behaviour as opposed to *instrumental morality* which focuses on self-interest (e.g., foregoing medical treatment to avoid pain, drowsiness, and discomfort) [8]. This way, IRIS ensures that both medical knowledge and moral reasoning are enhanced. After each session, Angelica, the AI nurse, will reward the player with additional levels in their most-played minigames.

### B. Social-Emotional Learning Activities

Young patients' social and emotional needs during treatment have been found to severely affect the healing process [9]. To this end, several activities are proposed which address the needs for connectedness, companionship, communication, and support. More specifically, interactive mini games, sports games, social encounters, and personalized figures in the form of Angelica and a pet dog will serve to add to a sense of community and emotional reinforcement that hospitalized children are so often in need of.

#### Collaborative Mini Games

Throughout their gameplay sessions in IRIS, hospitalized children will have the option to participate in mini games with fellow young patients or children playing IRIS throughout the world. These games will include both collaborative as well as competitive elements, so that the young patients feel a sense of accomplishment upon winning and a drive to keep playing with their online friends. Games that can be used to foster this sense of community would include platformer puzzles where multiple players are needed to finish (e.g., one player must stand on a platform for the other to pass, and either both win or both lose). A library of traditional arcade games like Tic-tac-toe, Snakes and Ladders, Chess, and other similar games will emulate the in-person board game experience that hospitalized children normally miss out on. Games will be available to play on a daily basis.

#### Virtual Competitive Sports Games

Research on virtual sports games [10] suggests that virtual

games improve hospitalized children's targeted body movements. In specific, the category of sport video games has been rated as second highest in terms of interest by hospitalized children who experience higher levels of overall satisfaction with hospital life due to VR games [11]. In addition, studies using VR games as an intervention for children with cerebral palsy have revealed significant positive effects on children's physical activity [12]; in addition to entertainment, virtual sports games offer children opportunities to develop and exercise their motor skills (as they require movement) in an enjoyable way [10].

Several virtual sports will be available in IRIS for children to participate in and play throughout the day. Young patients will be able to invite their friends to play alongside them; if no friends are available, they can choose to play against Bots; that is, AI opponents, which will be controlled by the program itself [13]. The difficulty of the AI opponents will be set by the player, from "easy", to "medium", to finally "hard", so that the gameplay does not become boring. Sports available will include football, basketball, volleyball, and tennis. The players will be given instructions on how to move their avatar on the field and how to score a goal. Even though pre-existing rules of these sports apply in the virtual game as well, the games will also include tutorials with simple instructions on how to play. By extension, the games belonging to this category would increase during seasonal events- the winter season would include skiing and snowboarding downhill for timed segments, and the players would then be able to compare their time to other players' times through a leader board system. The summer season would, by the same token, increase the game catalogue with water sports like jet skiing, canoeing, surfing, and fishing. Participation in the games will require the use of virtual reality equipment for maximum immersion in the game environment accompanied by physical movement.

#### Psychodrama and Art Therapy Sessions

Psychodrama is a structured type of psychotherapy, where individuals are asked to roleplay a situation along with other participants – young patients in this case - who are also enrolled in the session. This type of therapy allows people to process their traumatic experiences by re-enacting one's emotional states, work through their fears, and cope with their emotions, while working in groups [14].

Researchers exploring the effects of psychodrama interventions on young cancer patients [15] found reduced feelings of loneliness and negative perceptions of hospital life, while a sense of belonging and feelings of social support increased. This type of therapy also makes it possible for children to express themselves, not only by voicing their concerns, but also through body language and movements [15]. Art therapy sessions will also be an option for children in IRIS as they have proved beneficial to children with cancer due to their creative approach to dealing with and comprehending trauma, resulting in a better life quality [16]. Games that play on children's creativity, like being let to embrace their feelings through scribbling anything they want on a blank canvas, greatly promote children's need to express themselves in an

emotional, vulnerable way that helps them open up to themselves as well as others.

Research [17] suggests that the use of both interventions helped children with cancer overcome bio-psycho-social expressions of the conflicting nature of their everyday lives. IRIS will incorporate both types of therapeutic interventions in order to give the opportunity to a large group of young patients to deal with the significant changes they are experiencing due of their condition while in hospital. Both psychodrama and art therapy virtual group sessions will be scheduled weekly through the platform.

#### Virtual Birthday Parties and Sleepovers

In order to aid in the formation of friendships within the game and help young patients not miss out on potentially memorable life events such as birthdays, players will also be able to attend special events which may take place any time during the week. To participate, players must receive an invite from the organizer and accept it, after which point the event's details will be added to the weekly online calendar. These events will vary from virtual online birthdays, wherein children can visit the birthday person's customized hospital room through the form of their in-game avatar and spend time with their friends, to sleepover parties, where children will get to 'spend the night' playing cooperative mini-games and watch videos together. These special events can even extend to group travel, allowing a virtual field trip reward from another mini-game to be cashed in not in a solo form, but in a group with friends who might be invited along. This way, the game encourages children to build communities with their friends and to make memories together with them.

#### The Virtual Pet

Having a virtual pet is an important feature of the IRIS program. People, and especially children, feel the need for unconditional support and affection, a need which is rarely fulfilled by other people but can be satisfied through the company of pets [18]. Children often regard their pets as friends or family, where pets serve as agents of emotional support and affection [19].

The positive psychological and emotional benefits of having a pet have received particular attention in the treatment of hospitalized children with cancer and other long-term illnesses. More specifically, pet play therapy has been associated with an increase in positive emotions and a positive outlook on being hospitalized [20]. Hospitalized children view pet therapy, or animal-assisted therapy, as a fun process and exhibit excitement and anticipation to the event [21]. Instead of lingering on negative feelings likely resulting from their illness, young patients are motivated to play and further wish to own a real pet. Pet play therapy has also proved particularly successful before surgeries as it fosters and nurtures positive emotions [20], as well as after surgical operations, one of the most stressful events for chronically ill children. On a biological level, stress hormones decrease after pet play therapy [22] and patients experience fewer negative emotions like worry, stress, fear, sadness and pain after taking part in it [23].

IRIS will offer players the opportunity to virtually pet, groom, feed, play fetch, cuddle, and teach tricks to their dogs. Additionally, the virtual pet dog will be able to express itself through speech/text bubbles and carry a conversation. The inclusion of a *virtual* dog is preferred over physical pet therapy which may result in children getting sick or developing infections from coming into contact with animals [22].

#### The Virtual Nurse

Artificial intelligence has contributed significantly to the changing patterns of communication among people. During the COVID-19 pandemic, social isolation resulted in higher levels of depression and anxiety; an unusual solution was forwarded to combat the sense of loneliness, and this was through the use of AI chatbots. People who made use of AI chatbots reported feeling relieved from depressing feelings and anxiety [24]. Literature on hospitalized individuals and AI companions, however, is rather limited, since the development of robot companions such as Edu and Shaun are in their early stages [25], [26].

IRIS is to address young patients' needs for connectedness, further including a virtual nurse – Angelica - an adult figure who will primarily serve as health personnel, assisting the young patient with their daily/weekly leisure and learning activities, as well as with their medical obligations and practices. Angelica is an AI nurse who is programmed to be compassionate and assist the player with several tasks, promoting a relationship-based social interaction. Angelica will initially assume the role of a tutorial guide for IRIS, providing helpful information about mini games and other activities. Angelica will have dialogue options to converse with the player by providing digestible medical facts about their condition and offering comforting words, also fostering perspective taking. The AI nurse will remind children of upcoming medical obligations, such as medication, tests, or appointments, and will monitor and notify them about their health status (e.g., blood pressure or sugar levels). Before the daily login gift retrieval, Angelica will ask the player how they are feeling on the given day on a "mood of the day" reflection scale of 1 to 10. Ideally, the game will then adjust the day's available activities to better correspond to the child's emotional and physical state. Examples of how such adjustments will happen include an activity prompt to pet and groom their dog if they were not feeling well on a particular day, or Angelica prompting the child to 'vent their frustrations' in the form of a written text or a drawing. Last, Angelica will express empathy through dialogue options with the children showing understanding towards their fears, thus helping them combat their anxieties that are related to doctors and medical exams which can be uncomfortable or traumatic for some young patients.

#### C. Operational Details and Game Features

When logging into IRIS for the first time, the young patient will be able to create an avatar that best represents them, as well as choose their pronouns, their school grade, and their outfit. IRIS is a game for children, the visual and graphical aspects of the game will use vibrant colours that are friendly and

welcoming to look at. The customization stage of IRIS will not only include the physical avatar of the child, but also give them the opportunity to list their hobbies, their favourite food, songs, and activities, their school grade, how long they have stayed in hospital, including their diagnosed condition. The young patient will also be able to customize the personalized virtual nurse, who will be accompanying them throughout their day, and their customizable pet in the form of a dog. The player will be able to choose the dog's name, breed, size, and personality to their liking. All activities and play sessions will start in players' virtual hospital room that the child has customized freely. An in-game help menu will take the form of a school notebook.

Entering the game with their avatar, the child would be met with a list of daily tasks to choose from, serving both learning and socioemotional needs. IRIS will provide different levels of school subjects and related minigames in a sense of linear progression. Children using these features would enter a leader board with all other children playing the game, creating a sense of competitiveness whilst also fostering a feeling of community. Additional features will be added the more they progress through the game.

To increase engagement, IRIS includes a reward track- a recurring system that rewards the player with gifts on a daily basis at the time that they log in. Gifts may vary from additional wardrobe choices, like a new hat or sunglasses, to other cosmetic choices for their pet dog or even their room. Seasonal events, like skiing and snowboarding, going to the beach, or taking a trip to another country will be accompanied by the presence of Angelica and their dog. Angelica would become a source of facts about particular minigames as a tutorial guide, whereas their pet would assume the role of an emotional support companion. After each seasonal event and trip abroad, the young patient will receive souvenir items that they can then add onto their virtual hospital room to remind them of the fun they had while playing, as well as to increase their motivation to travel to more places and add new souvenirs to their personal comfort zone.

### III. STRENGTHS OF THE GAME AND CONCLUSION

IRIS, the interactive game that we are proposing, entails various features which produce a rewarding learning experience for hospitalized children with illnesses. The virtual space is a relatively fresh frontier, and it can provide many possibilities that would otherwise be limited by our immediate environment, helping hospitalized children cope with their conditions while at the same time offering opportunities to take ownership of their learning and personal agency of their condition. IRIS therefore becomes an interactive platform employing effective coping mechanisms to help hospitalized children in acquiring a sense of routine and normalcy, aiming to improve their children's mental and physical health in creative new ways. Through this virtual game, we strive towards building a repertoire of learning and socio-emotional skills whilst including entertainment.

To tackle the educational needs of the hospitalized child, IRIS incorporates school subject lessons and quizzes with a system of progression that rises in difficulty. Furthermore, the

game contains short video content pertaining to information that could help the patient understand their symptoms and their condition by educating themselves in regard to it. Adding minigames themed around doctors and the hospital environment is important as well, as it will help the children understand and familiarize themselves with the doctors' equipment rather than fearing it. The development of a child's cognitive, moral, and reflective skills, while practiced through gaining further knowledge on their condition and the space they reside in, also hinges on ethics.

The inclusion of the virtual pet dog, the comforting presence of AI nurse Angelica, and the ability to play games with other children patients using the same virtual platform aim at fostering young patients' social and emotional development. The importance of IRIS toward satiating emotional and social needs further reflects on the inclusion of virtual birthdays, a significant and memorable aspect of any childhood. An unmistakable asset included within the game is the way that it allows children patients to understand and confront their emotions by presenting them with a mood-of-the-day scale on a regular basis, their response to which tailors their experience of the game for the remainder of that day. Tying into IRIS' paramount role in the betterment of the socio-emotional state of children with severe conditions, events such as monthly or even weekly virtual sleepovers with other children as well as parties with seasonal themes (e.g., Halloween) serve to foster a sense of community that improves emotional and social growth and stymies feelings of loneliness that are often associated with staying at a hospital for long periods of time. These types of events do not need to promote children's need for information or have an educational purpose, but rather put emphasis on creating a unique social experience through IRIS and developing a sense of inclusion.

The effectiveness of IRIS toward the social, emotional, and cognitive development of hospitalized children cannot be understated, since it promotes self-awareness through gaining knowledge and interacting with other children in similar situations as themselves. IRIS provides a form of healthy escapism; diverting these children from their everyday pain and otherwise drab hospital routine by letting them engage in activities that have creativity and entertainment at their heart. By avoiding video game addiction through time-locking content and urging the children to take regular breaks, IRIS will prove itself as a worthwhile medical tool, a fun game, and a cost-effective method for helping hospitalized children deal with adjusting to their time spent at the hospital and transfer those skills after their release from the hospital, at home.

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