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A Model & Ubiquitous Computing Technology for Children's Disabilities (Case: Physical Disabilities at Red Zone Locations in Pandemic)

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Abstract: - A UNICEF 2022 report predicts that the impact of the pandemic (COVID-19) has been felt from 2020 to 2023 on every person and community, including children with disabilities. This situation occurs due to the unpreparedness of the health service system and in dealing with the pandemic. Unpreparedness in the quality of health services and many fatalities must be anticipated and of concern to disabled people and disabled children. Based on data from UNICEF (2021), the number of children with disabilities in 2021 will be 200 million, and it is predicted that there will be 250 million in 2022-2025. Public Health England revealed that in 2020, around 451 per 100 thousand people with disabilities died from Covid-19. Children with disabilities receive special attention because they are not like normal children. Disability children cannot carry out activities like ordinary people. Preparing a city with the support of a Red Zone Location is an anticipation for children's activities in the environment when dangerous conditions occur during the Pandemic. In this research, disabilities considered are Physical Disabilities. This is a focus because children with this disability have difficulty moving. The development of smart model technology with artificial intelligence in healthcare, including pervasive systems and the Internet of Things, must be provided to increase lifesaving and reduce disaster victims to support medical services for children with disabilities.

Keywords: Smart Model Technology, Children with Disabilities, Ubiquitous Computing, Physical Disabilities, Artificial Intelligence, Pervasive systems

I. INTRODUCTION

Based on data for the end of 2021 from UNICEF, there will be at least 250 million children with disabilities in the world in 2022-2025, but this figure may be even higher. They are also among the poorest representatives of the population [15] [16]. This data will continue to increase significantly in recent years. They continue to go to school, have access to medical care, or hear their voices in the community [15]. Their disabilities often put them at a higher risk of physical violence and frequently prevent them from accessing sufficient care or humanitarian assistance in emergencies [15].

The coronavirus (COVID-19), a Pandemic in 2020 until 2022, is a disease that spreads rapidly worldwide, causing every country to add more hospitals to face it [1]. Moreover, the medical service for those hospitals that are known to it must be deliberated since it comes with the special needs children to understand what kind of healthcare they need [2], according to the result of the study by Dong Y et al. in 2020 [2] on children in general. There were 1407 (65.9%) suspected cases and 728 (34.1%) laboratory-confirmed cases. All patients were seven years old on average (interquartile range: 2–13 years), with 1208 case patients (56.6%) being male. More than 90% of individuals had mild, moderate, or asymptomatic conditions. A median of two days passed between the onset of the disease and the diagnosis (0–42 days). Early in the epidemic, there was a sharp rise in condition, followed by a slow but steady decline. Over time, the illness quickly spread from Hubei Province to neighboring provinces. Hubei province has the highest number of infections among youngsters of any region.

From that case, it concluded that Children of all ages appeared susceptible to COVID-19, and there was no significant sex difference [3]. Furthermore, from those results, it can be hypothesized that children with special needs are more vulnerable than normal children. However, some problems still need to be compromised by every government worldwide, such as Limited care, restricted health services, and an Unhealthy household environment [4]. Public Health England revealed that in 2020, around 451 per 100 thousand people with disabilities died from Covid-19 [15] [16].

Recently, many technological models have been proposed to help human tasks, including Smart Model Technology. When artificial intelligence (AI) is used to create automated, intelligent, and smart systems that meet

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the demands of the modern world, this is referred to as smart model technology [17]. Building such systems requires modeling based on AI. An application's intelligence and capabilities can be increased by using a variety of AI types, including analytical, functional, interactive, textual, and visual AI [17]. However, creating an effective AI model is difficult, given the dynamic nature and variability of real-world problems and data [17].

Dr Ruben Puentedura's SAMR model is one instance of smart model technology [18]. The SAMR model offers a structure for illustrating how technology affects instruction and learning. The paradigm goes through several phases, starting in the substitution phase with a basic level of knowledge and ending at the redefinition level [18][19], when learning is transformational. The use of smart model technology in the medical field is another illustration. Virtual reality and other smart technology allow doctors to work remotely and deliver better treatment [20]. There are numerous uses for smart model technology in various industries, including cybersecurity, smart cities, business, finance, healthcare, and agriculture [17]. It is a leading technology in the contemporary era of the Fourth Industrial Revolution, often known as Industry 4.0 [17].

The COVID-19 pandemic has significantly impacted children with disabilities. Due to the pandemic, rehabilitation centers have closed, making it difficult for children with impairments to get the therapy and care they need [22]. In addition, caregivers have had challenges managing families and assisting children with disabilities in adjusting to changing schedules [22]. Nevertheless, children with disabilities have experienced psychological and emotional strain. It's critical to comprehend the effects of the pandemic lockdown on these kids' disabilities and their families while also searching for workable answers [22] [23]. To highlight the experiences of children with disabilities during the epidemic, to promote the availability of various services both now and in the future, and to guide the development of interventions, research, and data gathering are required [23]. It's crucial to think about the security and welfare of children with disabilities during a pandemic since they could be more susceptible to certain dangers [23]. The following things need attention and can be called red zone areas or dangerous locations: crowded spaces with inadequate ventilation. Viral transmission is more likely in crowded indoor environments with insufficient ventilation.

A report released by the US Centers for Disease Control and Prevention indicates that during the COVID-19 pandemic, children received a higher diagnosis of developmental impairments compared to the previous year [23].

This paper's research focuses on understanding the possibilities of the smart city and building a pervasive model and Internet of Things (IoT) to support children with disabilities in disease prevention and medical treatment during the COVID-19 pandemic. The methods of this research are content analysis. Previous research on smart systems that emerged during the pandemic [5, p. 1] created the potential model of the smart strategy for medical treatment to support children with disabilities with the hardware and the system of the city and building. In this research, disabilities are considered Physical Disabilities. This is a focus because disabled children with this disability have difficulty moving.

II. SMART MODEL TECHNOLOGY

A. Smart City Technologies

The previous study used many smart system models to improve the city's and buildings' quality. After the pandemic emerged, there was found change in urban life from “living outside” to “home outside”, which has some effects such as traffic reduction and the increase in internet use [6, p. 12]. Moreover, according to Umair et al. [6, p. 12], there is also another urban technology that emerged during the pandemic, such:

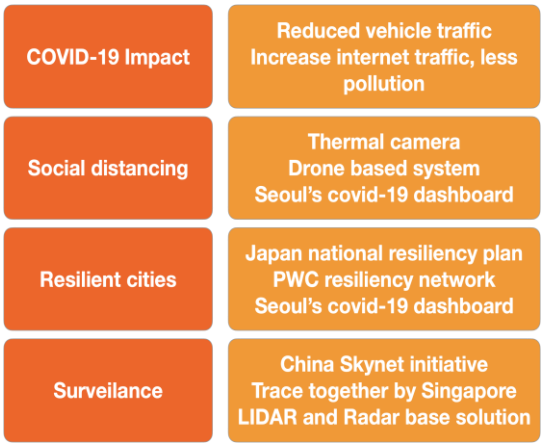

Figure 1: Recent Developments in Smart Cities in the Wake of COVID-19 by Umair et al. [6,p.12].

Furthermore, according to Jaiswal et al. [7, p. 84], the smart city technology that emerges to reduce the pandemic's impact can be classified into several types: smart technology, smart healthcare, smart delivery, and others.

Figure 2: Different types of smart city technology for reducing COVID-19, by Jaiswal et al. [7, p. 84]

B. Smart Building Technologies

The pandemic also affected the technology related to smart buildings; according to Umair et al. [6, p. 10], the technology of smart buildings that emerged during the pandemic is classified into three categories: visitor management, facility cleaning robots, and HVAC systems. Figure 3 shows the further development that occurred during the pandemic.

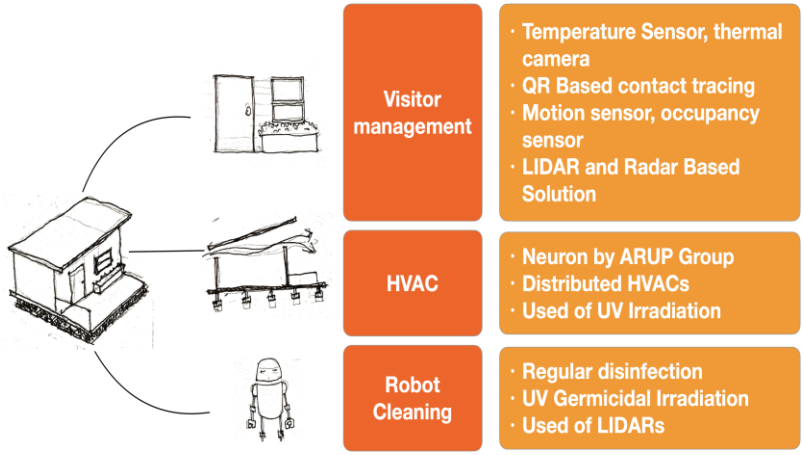

Figure 3: Recent Developments in Smart Buildings in the Wake of COVID-19. By Umair, Et al [6, p. 10]

C. Potential smart building model for children with disabilities

According to the World Health Organization (WHO) [10], there are many common symptoms indicated as covid-19 symptoms, such as

a) fever
b) cough
c) tiredness
d) loss of taste or smell

Moreover, WHO also classified other symptoms as a severe symptom of COVID-19, such as,

a) difficulty breathing or shortness of breath
b) loss of speech or mobility or confusion
c) chest pain.

Furthermore, the technology of smart buildings should consist of the detection of COVID symptoms in the houses that live by children with disabilities.

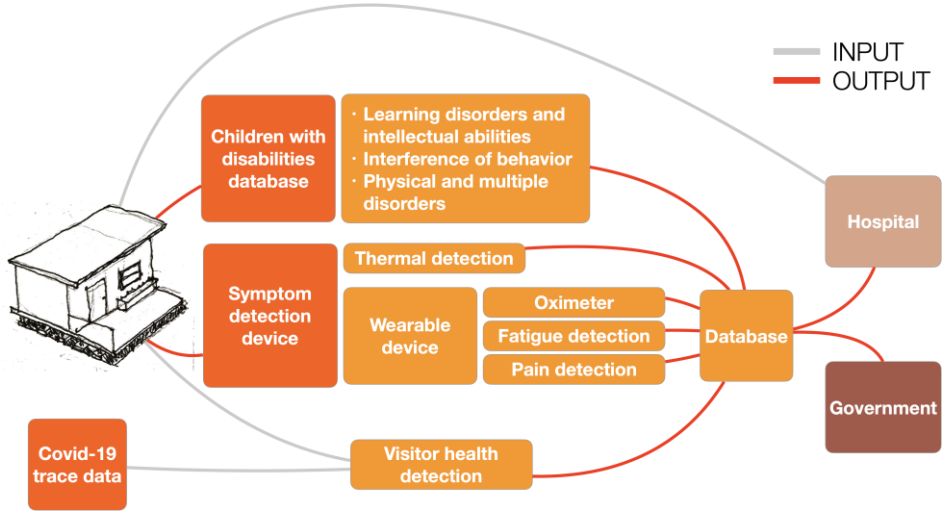

Figure 4. Potential Smart building model to improve medical treatment for children with disabilities during COVID-19.

Figure 4 shows the potential model of a smart building for children with disabilities. First, the building should have a database of disabled children, including the type of disability, and compile d into one database. Moreover, the house should have a detection device that corresponds with the Government COVID-19 trace database and has thermal detection. In this place, the children need to wear a device that can detect the common symptoms of COVID-19, such as an oximeter, fatigue detection, and pain detection [11], [12]. Moreover, the data are compiled into one cloud database to be sorted to show the most medical emergency needed among the children.

III. RED ZONE LOCATION AND PHYSICAL DISABILITIES

The pandemic is causing a problem across the world. Children also face the problem of disabilities; according to Schiariti [8, p. 1], children with disabilities are facing human rights problems such as a lack of inclusive humanitarian response, neglect, and separation from family members. Moreover, during the pandemic, it emerged the paradigm shift related to physical therapy for children with disabilities from offline to online [9, p. 2]. The paradigm shift is insisting the technology development to provide the infrastructure to support it.

According to a Harvard Health article, the pandemic has affected persons with disabilities' lives in a variety of ways, including social services, employment, education, and health care1. For many persons with physical or intellectual disabilities, learning new skills, working, or performing daily living tasks requires highly specialized programs and one-on-one direct help. Certain people could find it more challenging to use technology or to work and study in virtual environments. Many only interact with others through their jobs, schools, or community activities. Thus, it is particularly challenging to deal with the impact of restricted social networks and intense seclusion during the pandemic [25].

According to the Mayo Clinic, individuals with physical disabilities such as cerebral palsy, stroke, spinal cord injury or dysfunction (SCI/D), amyotrophic lateral sclerosis (ALS), and Multiple Sclerosis (MS) may be more susceptible to pneumonia and severe disease if they are in a red zone [26]. COVID-19. According to a UCL study, those who are physically disabled have been recognized as being especially vulnerable to the pandemic. Mobility issues may make it more difficult for them to obtain social services, health care, and informal care [26] [27].

It's crucial to think about the security and welfare of children with disabilities during a pandemic since they could be more susceptible to certain dangers. Some settings and scenarios can be more difficult for these kids, even though there aren't explicitly "dangerous" places or Red Zone Locations. The following things to bear in mind are:

1. Densely populated, poorly ventilated areas:

Densely populated indoor settings with inadequate ventilation raise the possibility of virus transmission. Children with impairments may be more prone to infection, particularly if they have respiratory problems. Avoiding crowded places is advised, particularly when social separation and mask-wearing are not enforced [23].

2. Medical facilities:

Despite being necessary for providing healthcare, hospitals, and clinics can pose a high risk during a pandemic because of the higher chance of contracting infectious organisms. Because their immune systems may already be weakened, children with disabilities should always be accompanied by adults who closely monitor their hygiene and safety when in medical facilities [25].

3. Long-distance travel:

During a pandemic, children may be exposed to a greater variety of situations and people when they travel long distances. For children with impairments, who might need extra attention and accommodation when traveling, this can be particularly difficult. When traveling, preparing and taking the appropriate safety measures is crucial.

4. Schools and daycare facilities:

They may be open or closed, contingent upon the local pandemic scenario and vaccination rates. If you plan to send your child to one of these facilities, be sure they follow the safety procedures and guidelines. During a pandemic, homeschooling and virtual learning may be safer alternatives.

5. Therapy clinics and rehabilitation centers:

If your child receives therapy or rehabilitation services, think about the hazards involved in having them visit these establishments. For certain services, telehealth options might be accessible; it's a good idea to discuss these choices with healthcare practitioners.

6. Social events and group meetings:

Social events, parties, and gatherings may be dangerous during a pandemic. The risk of exposure is increased for children with impairments because they may find it challenging to maintain mask wear and physical distancing. Consider how important it is to attend these events and put safety first.

7. Low-vaccination areas:

It's critical to understand the vaccination rates in your neighborhoods. Children with disabilities are more at risk in areas with poor immunization rates since these areas may also have more excellent rates of transmission. Keep yourself updated on regional health regulations and norms.

It's critical to stay informed about public health recommendations, adhere to suggested safety precautions, and seek individualized guidance from healthcare specialists to keep disabled children safe during a pandemic. Precautions could also be taken by minimizing exposure to high-risk regions, assuring adequate ventilation in indoor spaces, and practicing excellent cleanliness.

IV. Ubiquitous Computing of Smart Technology Children at Red Zone Location

To implement the smart building system, ubiquitous computing is the potential method of computing that can be used. Based on Mühlhäuser and Gurevych [13, p. 10], two types of ubiquitous computing can be added to the smart building to support disability children, can shown in Figure 5.

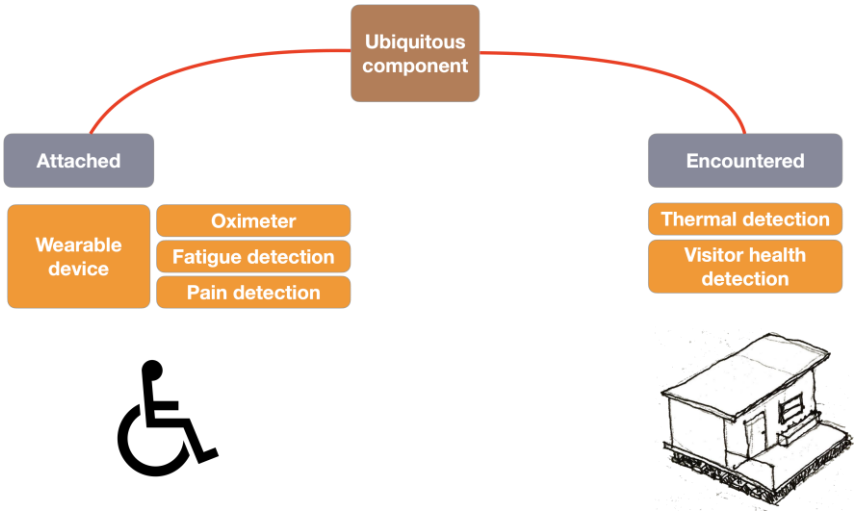

Figure 5. Ubiquitous computing in Smart building model, Source: [13, p. 10]

The ubiquitous components used in this model are split into two types; one of them is the “attached to human” part, which is the device that is worn by disabled children and encountered components planted into the house.

A. Potential Smart City Model for Children with Disabilities

The data obtained by the smart building are visualized into geographic information related to traffic and nearby hospitals. The hospital will see the most needed treatment among the children to improve the efficiency of medical treatment for the child with disabilities during the COVID-19 pandemic (Shown in Figure 6).

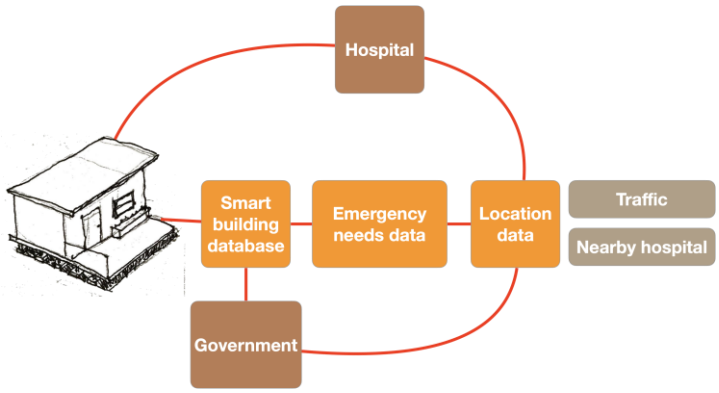

Figure 6. Smart City Potential Model to support children with disabilities.

B. Ubiquitous Computing in Smart City Model for Supporting Hospital

In the city context, the ubiquitous computing component is often shown as encountered items [14]. In this case, the data are obtained from the house and received by the server. In the hospital, it has planted a GPS device that gives information about its location. The server calculated the potential nearby hospital to the disabled children's house to improve the treatment efficiency in Figure 7.

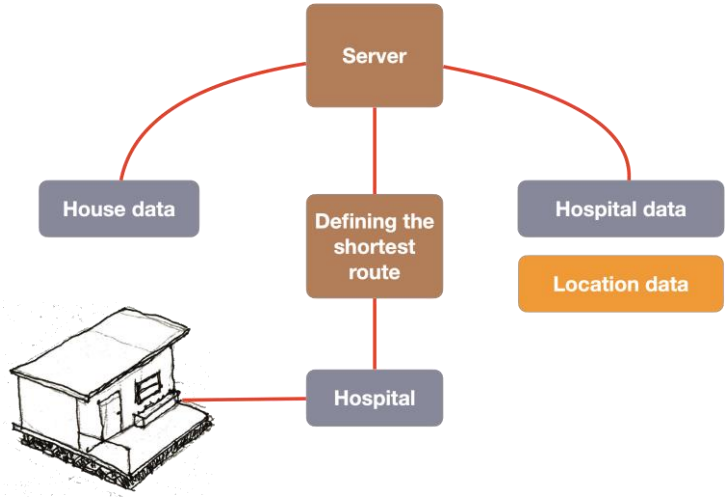

Figure 7. Ubiquitous computing to support hospitals in treating children with disabilities.

C. Red Zone Location and Children with Physical Disabilities

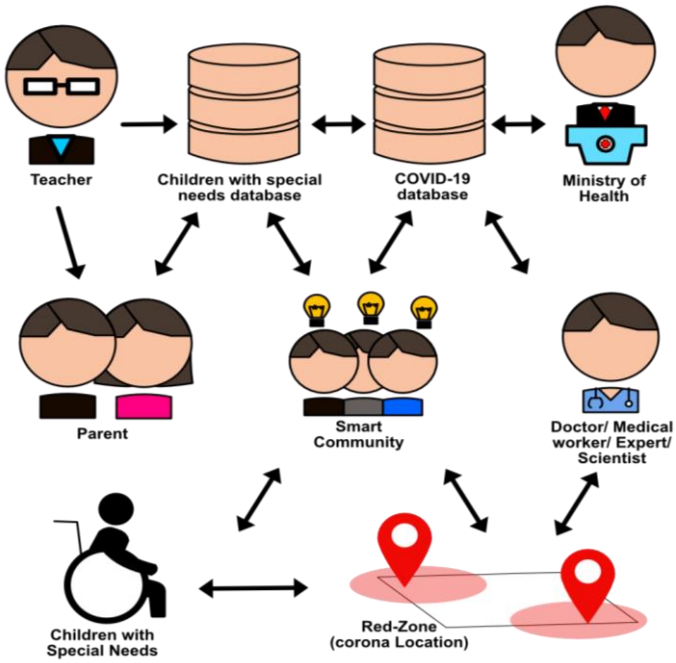

Figure 8. Model Proposed Technology Collaboration

From Figure 8, We can see the initial flow is that children with special needs at the Red Zone location are known as early as possible through data collected by Smart Community or data from teachers and parents connected to applications that are made and collaborative technology support systems support.

Data from teachers or parents can be updated or changed at any time if needed. This helps to evacuate if required at any time in children with special needs. In addition, parents and teachers send data related to the type of child with special needs. So, Schools and parents know the red zone's location and children with special needs who need this help.

On the other hand, doctors, medical workers, experts, or scientists perform data processing accurately and in real-time from the location of the red zone in an area. In addition, they also need to know the number of positive and negative confirmed children from COVID-19 from the Red Zone location. Furthermore, the minister of health knows the updated data and the location information of children with special needs from an integrated database of COVID-19. The children with special needs database is significant as the smart community's function. A Smart Community is volunteers, society, health workers, and the people involved help in this successful process.

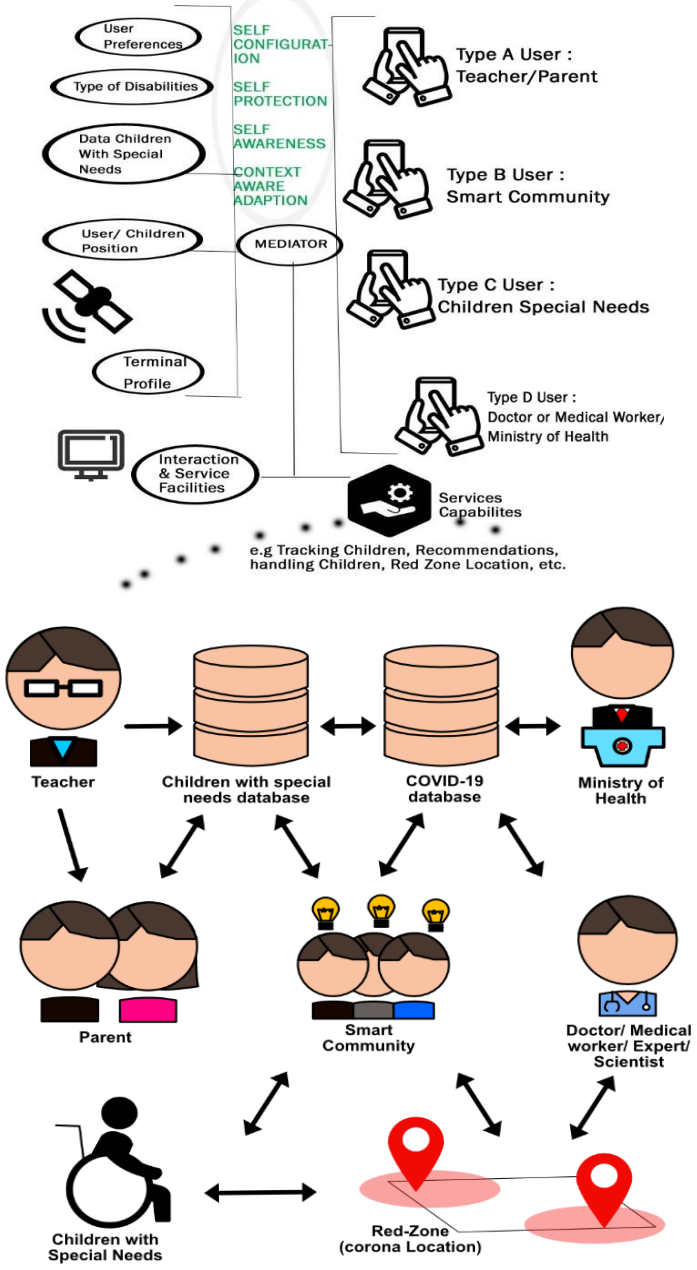

Figure 9. Model Proposed Technology Collaboration with SMART Model

From Figure 9, There are four user types to choose from or user access rights. Type A user with teacher members and parents. Type B are smart Community members, and Type C users are children with special needs. Type D is Doctor, Medical Worker, or Minister of Health. Some of the services from the Context Composition are User Preferences, Type of Disability to user positions, Interaction and Service Facilities. In Services Capability, there is support for Recommended Features [29-31], Red Zone Location, handling children in the red zone, etc.

On the other side, the Doctor or Medical Worker and the Expert or Scientist shall conduct correct and real-time data processing from the location of the red zone in the region. In addition, the number of positive and negative children reported from COVID-19 [26] at the Red Zone site must also be identified.

The Minister of Health is aware of the updated data and location information for children with special needs from the combined database of COVID-19 and the database of children with special needs. The position of the Smart Group is also vital in this respect. The Smart Community is a volunteer, an organization [30] [31], a health professional, and individuals interested in promoting this effective process.

Intelligent Scenario Analysis and Contextual Understanding of the Proposed Program

There are three types of services used for children with special needs in Figure 3:

1. Database A is the Children's Disabilities Data
2. Database B is the Fitur Helping at Red Zone Location
3. Kids with Disabilities can choose to handle children in the red zone

V. CONCLUSIONS

In this research, we still offer smart building models or buildings suitable in an intelligent city for Red Zone Locations in COVID-19 Areas with Artificial Intelligence and Pervasive Computing. The research related to the intelligent building and city about improving medical treatment for disabled children needs to be deliberated since the present study discusses the SMART Model, an initial overview of the Red Zone Location with the SMART technology offered.

There are four user types to choose from or user access rights. Type A user with teacher members and parents. Type B users are smart Community members, and Type C users are children with special needs themselves. Type D is Doctor, Medical Worker, or Minister of Health.

Some of the services from the Context Composition are User Preferences, Type of Disability to user positions, Terminal Profile, and Interaction and Service Facilities. In Services Capability, there is support for Recommended Features, Red Zone Location, handling children in the red zone, etc.

The technology offered by this technology is still in its initial stages and uses the SMART Technology Model. We will carry out further study, and hopefully, it will be helpful for children with disabilities, especially physical disabilities. The next research is Requirement Analysis, Applying Machine Learning, Processing Data Sets, and Data Modeling for Children with Disabilities.

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