Project Report

TövisCsapat · The Seers · Jövőbelátók

World Robot Olympiad 2022 | Future Innovators, Elementary

Our mission:
Patients in hospitals could heal faster when we care for their mental health and wellbeing no matter if they are kids or adults.

When you are in hospital healing process seems painfully slow and while hospitals care a lot for the healing of the body, they cannot pay enough attention to the healing of the mind and soul.

Changing this would require more time and more personnel, yet there are way too less nurses than this mission would require. Nowadays they besides the key tasks such as food distribution they cannot regularly take part in tasks such as giving away teddy bears, helping kids connect with their friends and family or tell fairytales to the ones who would need that for a happy sleep.

About our team

We are Kamilla Faragó and Klára Smohay, and our team is The Seers. We are from Budapest, from the Homoktövis Elementary School or Újpest and we know each other since kindergarden, so we have decided to form a team and challenge ourselves on the WRO Future Innovators competition.

We are a good team so we could distribute the tasks among ourselves effectively without any disagreements.

Kamilla is great in programming and robot building.
Klári is awesome in programming and acquiring new information.

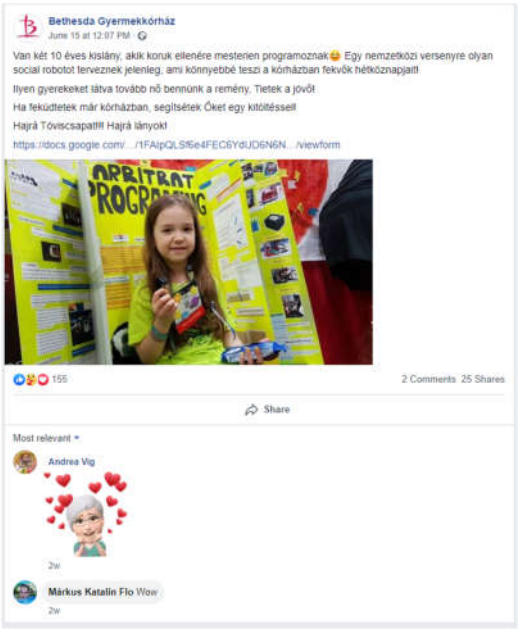
In each hospital employees have to work hard, so we would like to ease their work with robot helpers. Our imagination was quite wide, as we had at least 88 different solution ideas each, yet after a long discussion and design process we successfully selected 9 great parts that form our solution.

Research

Our Questionnaire

We have created a questionnaire to identify the key topics that people would find the most beneficial in a hospital. We have asked several questions and asked our friends, families especially the ones who have been to hospital lately to fill it in.

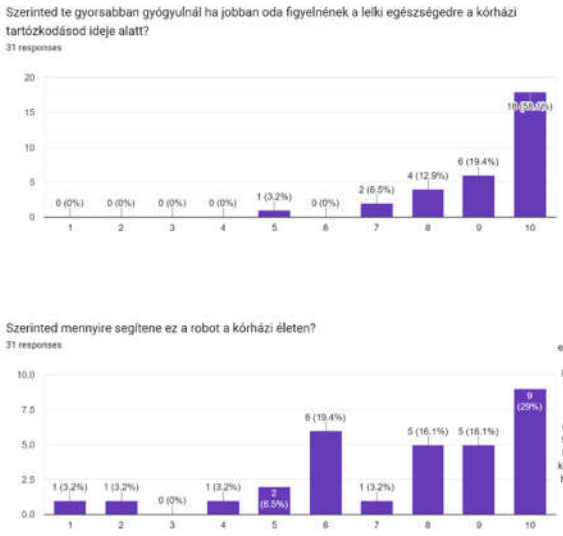
Bethesda Children Hospital have also shared our questions and we have received 31 responses so far. We have all the [aswers shared here](#).
Helping kids to stay up to date with learning received the highest score. 77.4% of responders think it would be useful. It is important as we have a friend who were in hospital for a longer time and afterwards, he needed two months to catch up!

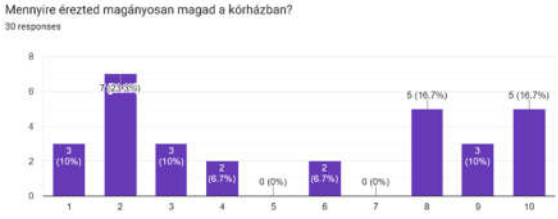


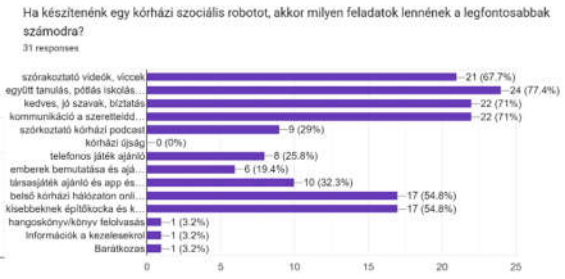
We have asked the following questions:

1. Please tell us about a negative experience from hospital of yours. Do you have any ideas how to improve?
2. Please tell us about a positive experience from hospital of yours that could be copied to other hospitals!
3. Do you think you could heal faster if someone would pay attention to your mental health?
4. Did you feel lonely when you were at the hospital?
5. How much could a robot improve the quality of a hospital stay?
6. What would you like to get from a hospital social robot?
7. If we would create a hospital social robot, which functions would be the most useful for you?

We have discussed the results of the questionnaire and aligned our solution list with it.







Project Idea Summary

In hospitals patients heal slower and time seems longer when focus goes only on physical healing and disregard mental healing. The root of the problem we have identified is that is that besides a few specialists only nurses could pay attention to mental healing, yet they are too few and must focus on more urgent tasks instead.

Many times patients do not have their beloved ones, friends and they feel bored and days go on very slow to them that leads to sorrow.

During our visit to the Bethesda Children Hospital, we have learned from **Dr. Tamásné Bese Nóra, Director or Communication and Public Relationship** that every hear they see 140.000 patients from which 12.000 spend several nights in the hospital, from which 20% are not accompanied by any parents. Some of them need to spend longer times even 6-12 months in a separate building.
Many of them have burn injuries, as Bethesda is the center of burned injuries for children.

- 140.000 patients
- 12.000 patients spending nights
- 20% children without parents

Advantages:

- Faster healing
- Mental healing starts in the hospital
- Lack of nurse problem easened
- Improved social relations and community building

From the 200 employees of the Bethesda hospital there are very few who can regularly spend quality time with the patients to improve their mental health.

Based on the questionnaire and the discussions we think that a robot working relentlessly for the patients and can work with them day and night in many ways.

In our solution we have focused on nine different mental support functions with three different collaborating robots.

Our project can be implemented in the real life as well according to the feedback we have received, yet it needs to scale up to 1-1.5 meters high for safety and robustness and the physical security of the robot.

Robotics solutions

We agreed to create three different robots that implement functions and collaborate when needed.

Luna Robot – to carry things around

We have build Luna based on the base robot Charly that is engaging and happy, yet versatile to carry out several tasks on the field.

Physical dimensions:

- Length 14 cm, Height 22 cm, Width 10 cm

Wheels

- Back wheels are standard SPIKE wheels with 5.5 cm diameter to stable moving and turning
- Has 3 follower wheels 3 of diameter with 2 cm. The small wheels are needed for good balance and easy turning.

Functions

- Moving forward and backwards
- Dancing
- Belly: Opens the belly to carry anything to the hospital rooms, carry items around
- Head: Display faces and any message or numbers on the hub, moves up and down
- Shoulder: touch button to acknowledge and continue the run

Belly

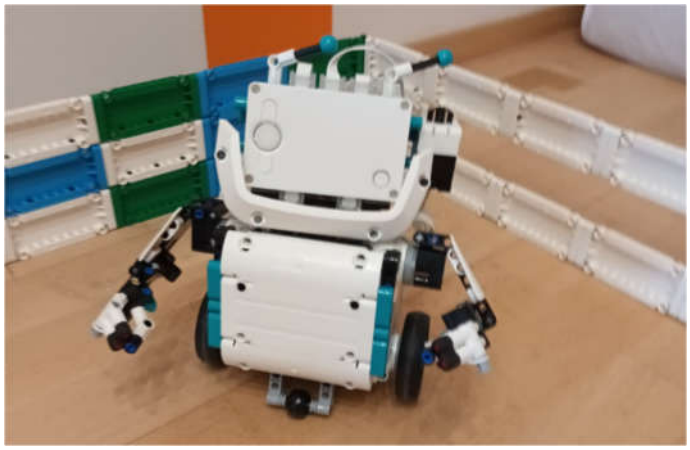
- Height 10 cm, Width 8 cm, Length 10.5 cm

Head

- Height 8.7 cm, Width 4 cm, Length 9 cm

Arms

- Height 9 cm, Width 0.5 cm, Length 10 cm
- Has three fingers 3 to grab things
- Can turn the arms even to the back
- A rubber band helps holding the fingers together to help carrying items around



Hermione - Lifting robot

Hermione will be our robot that is built to lift heavier objects.
It is build based on the OneKitProjects idea and consists of two small motors and a 5.5 cm wheel.

Hermione contains

- SPIKE Hub
- 2 medium motors with two small wheels
- 1 medium motor for lifting the forklift

Harry Communication robot

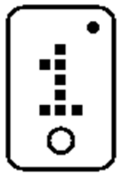
Harry is our smallest robot and is placed outside of the hospital.
As for the development we have used it as a bare hub and for the competition we will decorate it.

We are using Harry to demonstrate hub-hub communication to model the shared phone functionality.

Social functions

Below we detail out the functions of the robots that we have created and implemented.

#1 | Making a call to Home – “Luna the public hospital phone”



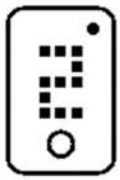
We have found out that some patients do not have access to a phone while being in the hospital. For them reaching home and bellowed ones makes a big difference.

When the family checks in with the kids, we can let them register and let them use a public hospital phone. In our model we put a separate hub to the home of the family.

- Place the robot to the room where you’d like to use the functionality
- Program 1 should be started on Luna (hospital)
- Program 1 should be started on Harry (home)
- The hub displays “Send You Message”
- In the model you can choose from three simple messages with the left and right buttons: “Hello”, “I love you”, “I Miss you”
- With a tap on the hub you can send a message using hub-hub communication. Message reception is displayed with blue, while message sending is displayed with green color!

We believe that patients, especially kids get much happier if they can connect to their family regularly.

#2 | Telling a fairy tail

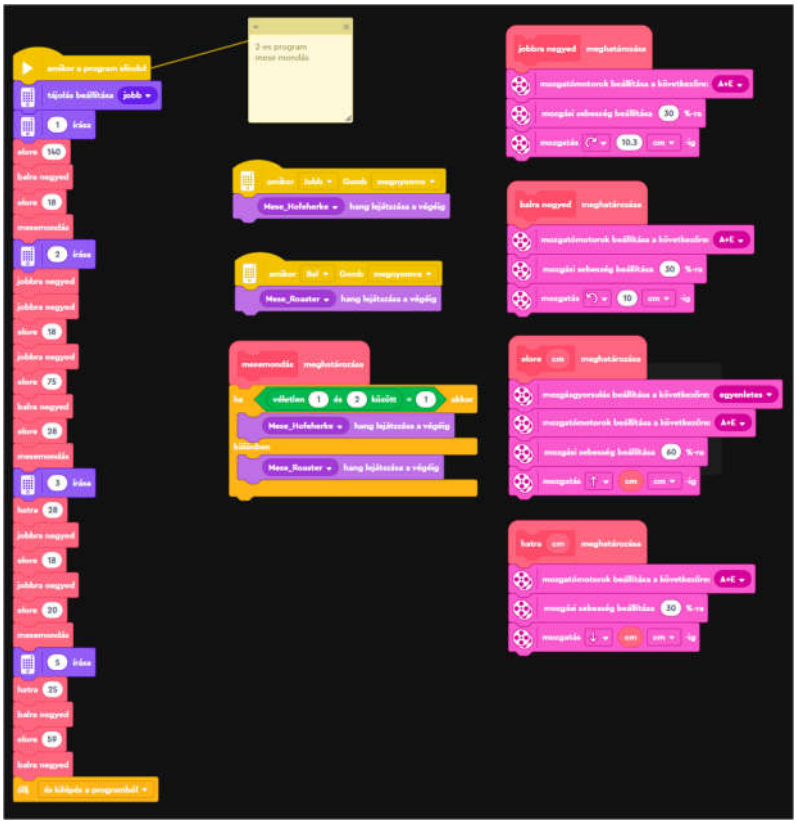


Patients in the hospital are happy to hear familiar stories and tales. With kids tales are used often to deliver learning, such as a bird that flies too close to the Sun – these are tales that helps healing.
So we have created a functionality to tell simple tales to the kids.

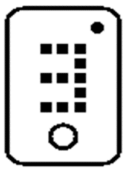
How it works:
The robot goes to each room and the kid can choose with left or right button between the tales. |For our exhibition stand we have shortened tales to 8-10 seconds long, yet, in reality, we would have full version of the tales of course! :-)

Usage:

1. put the robot to the start on the storage area
2. choose and start the 2 progra,
3. the robot moves to all rooms one by one
4. randomly plays either Klári's Kiskakas és a Gyémánt félkrajcárja tale short version in English
Or 4. randomly plays Kamó's Hófehérke és a hét törpe tale short version in Hungarian
6. after the round it returns to the start area



#3 | Playing music and singing a song



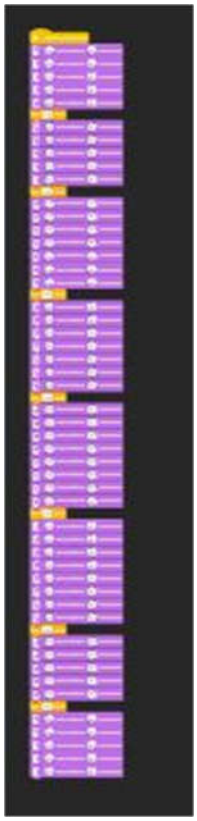
The robot goes patient in one of the room and plays a song or plays a calming music.

We are from a school that has a music faculty and we are really fond of music and singing – we thing that with music one can get entertained and can really relax.

In the hospital it is important that if someone does not have a phone but would like to listen to music or singing there should be some instrument that plays some calming notes.That is why we have created this functionality.
With Luna one can choose between the songs and music to play.

Usage:

1. We place the robot to the kid who would like to listen to music
2. We press left or right button
3. Left plays the “egyboszorka” song
4. Right plays the “bociboci tarka” song



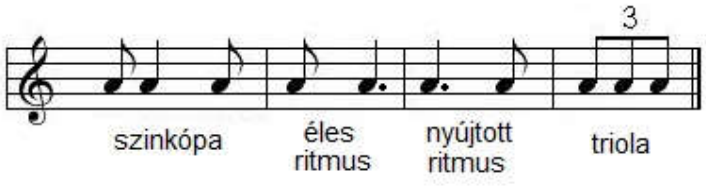
Challenges and solutions:

We have found that the hub cannot play any recording, and it will only be played on the computer connected.

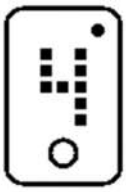
So we have found a solution that playing only notes will still play on the hub that is a much better solution for us.
So we have coded the music note by note.

The “Boci boci tarka” song makes kids laugh, and if they can laugh in the hospital that is a great happiness and success for us!

The “Egyboszorka van” song gives happiness to the kids as well!



#4 | Recommend a game to play

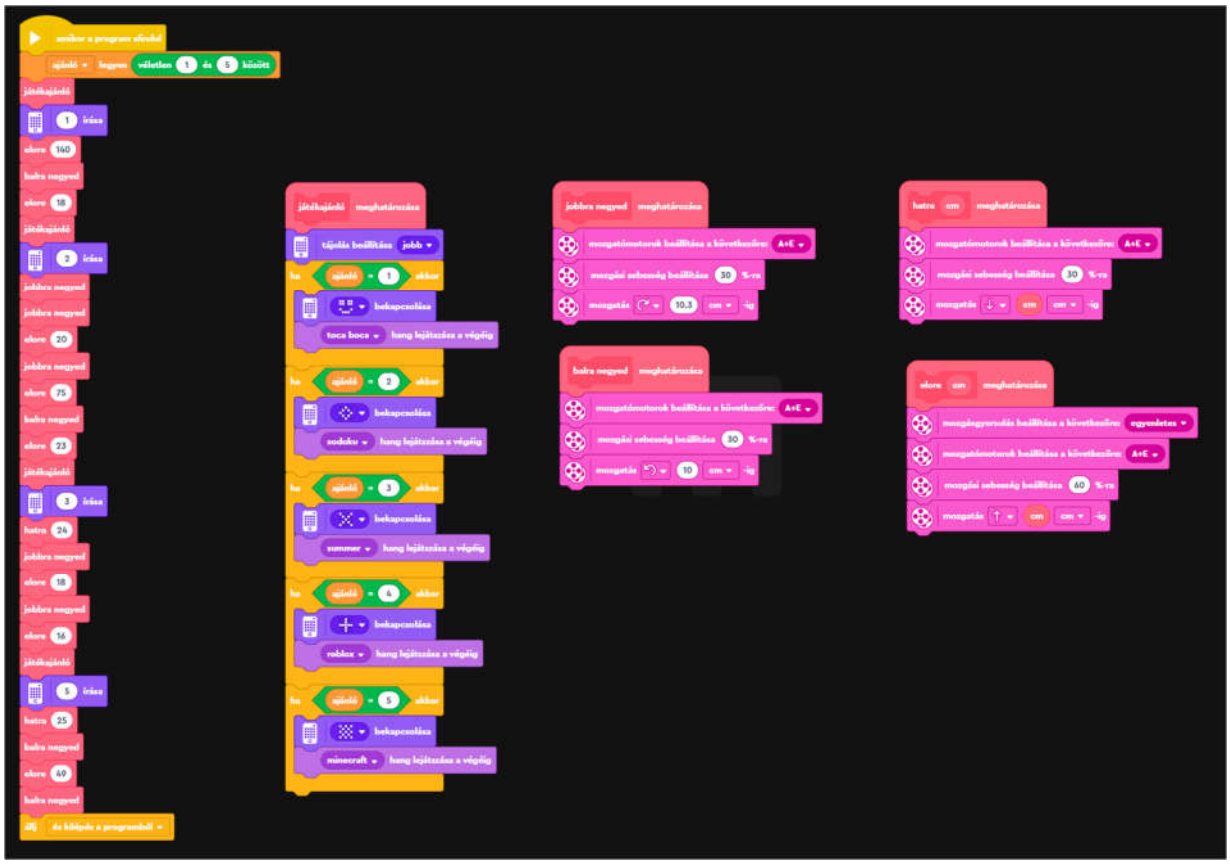


Why not recommend a random game to the whole hospital and let them play the same game for that day?
We think that building communities anywhere is a great idea!

We have used Luna to visit each room one-by-one.

Usage:

1. Robot is started from the Storage Start room
2. Robot randomly selects a game to recommend
3. Robot visits each room and says e.g. “Let’s play Sodoku!”
   we have created 5 different sound recording
4. Robot returns to the Storage room



#5 | Teaching a foreign language

Patients in the hospital have plenty of free time. If they could use it to learn new skills then time spent in the hospital could be a more engaging and useful opportunity besides the healing itself.

We have used Luna for this task.

Usage:

1. Robot is placed to the appropriate room
2. Robot program, 5 is started
3. The user presses left button for English or right button for German
4. The kid receives a random word in English or German
   and has to answer with the appropriate Hungarian word
   (not checked, used as a flash card)
5. Pressing the button shows the next word to learn

#6 | Hospital Podcast

As days in the hospital gets very long and news or interesting facts can make the day more interesting.

We think that a simple podcast can be a very good idea.

Especially when patients wake from artificial sleep, even after a very long and dangerous sleep (80 days, Soma) it is important to have human voice around, when no visual signal can make it through (first contact).

Podcast (human voice) can make the patient calm and relaxed and builds community.

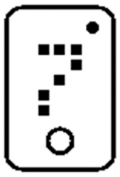
Creating the podcast

- Either the hospital can create the podcast and update it to make sure everyone receives interesting news or
- There are communities of healed who are committed to help others (Égettek) both personally and in any means
- *For this model we have created a simple and short podcast.*

Usage:

- Goes to the bed one-by one and tells the podcast

#7 | Introducing patients to each other



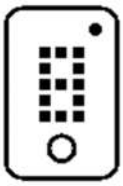
Patients in the hospital typically get in contacts with the neighbors and maybe some in the room.

We have discussed in Bethesda hospital that it would be very good to introduced patients spending some time, but not too long to each other so that they could make new friends in the hospital that would a bit help the lack of their friends and families.

Usage:

1. Robot is started from the Storage Start room
2. Robot randomly selects a room and goes to the room and says “Follow me to meet a new friend”
3. Robot is started from the Storage Start room
4. Robot randomly selects a room and goes to the room and says “Follow me to meet a new friend”

#8 | Delivering Toys and Teddy Bears to Patients



Every kid like teddy bears as it reminds them to the ones they sleep with at home. They are like family members, and it feels like being with family. We love to hug them, play with them like they would be alive. When the robot goes to a kid it is still a surprise what he receives.

This is very engaging for him as it feels like you have a birthday, and every kid loves to receive presents.

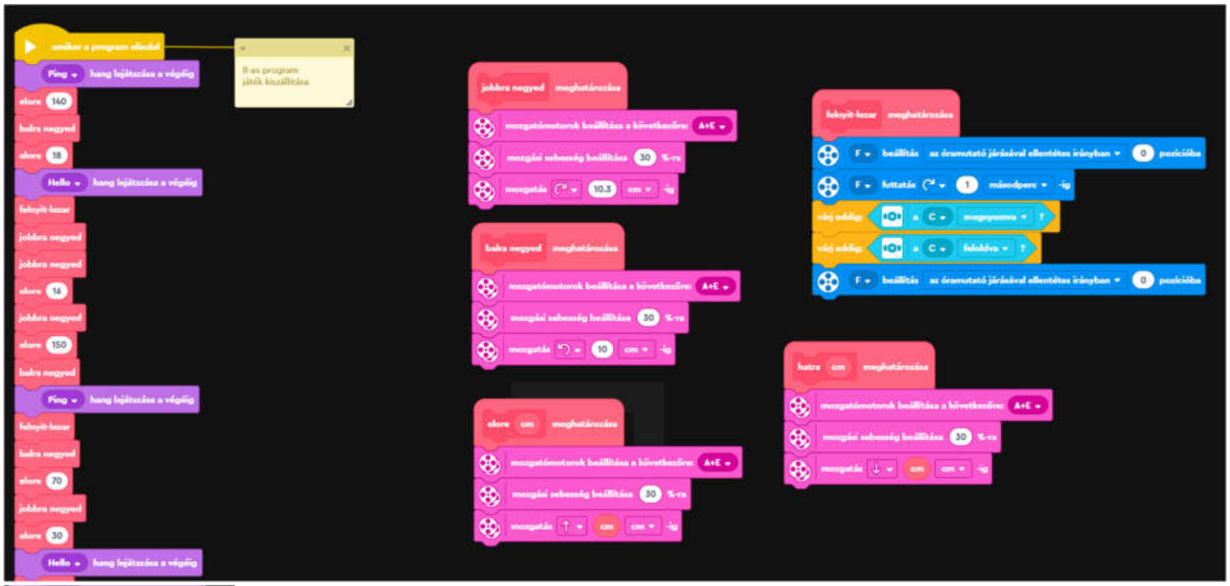
Robot look and feel

The robot looks like a small person. The legs are rolling wheels and the body consists of panels. The head is on horizontal so that it looks like eyes, with nice antennae on the top. When one of the arms are raised the belly is opened so that the small surprise gets revealed. The shoulder has a touch button.

Usage

- Robot is started with an empty belly storage
- The operator fills up the belly with a small toy to deliver and starts it
- Robot goes to the first room and stands by the bed and opens the belly automatically
  The kid takes the present and presses the touch button to indicate that the robot can continue
- Robot returns to the storage room and waits until the operator fills it up again
- Robot goes to the second room and stands by the bed and opens the belly automatically
  The kid takes the present and presses the touch button to indicate that the robot can continue
- Robot returns to the storage room and waits until the operator fills it up again
- Robot goes to the third room and stands by the bed and opens the belly automatically
  The kid takes the present and presses the touch button to indicate that the robot can continue
- Robot returns to the storage room

We have experimented with speeds from 30-60% depending on reliability and speed, and also added acceleration control.


amikor a program elindul
8-as program
játék kiszállítása
Ping hang lejátszása a végéig
elore 140
balra negyed
elore 18
Hello hang lejátszása a végéig
felnyit-lezar
jobbra negyed
jobbra negyed
elore 16
jobbra negyed
elore 150
balra negyed
Ping hang lejátszása a végéig
felnyit-lezar
balra negyed
elore 70
jobbra negyed
elore 30
Hello hang lejátszása a végéig
jobbra negyed meghatározása
mozgatómotorok beállítása a következőre: A+E
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balra negyed meghatározása
mozgatómotorok beállítása a következőre: A+E
mozgási sebesség beállítása 30 %-ra
mozgatás 10 cm -ig
elore cm meghatározása
mozgatómotorok beállítása a következőre: A+E
mozgási sebesség beállítása 30 %-ra
mozgatás cm cm -ig
felnyit-lezar meghatározása
F beállítás az óramutató járásával ellentétes irányban 0 pozícióba
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várj addig: a C megnyomva ?
várj addig: a C feloldva ?
F beállítás az óramutató járásával ellentétes irányban 0 pozícióba
hatra cm meghatározása
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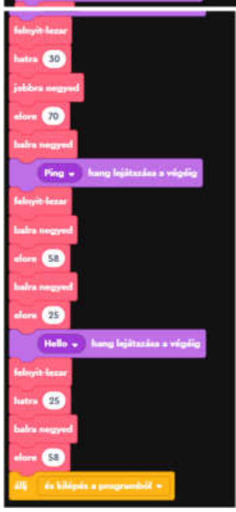
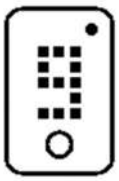
mozgatás cm cm -ig


felnyit-lezar
hatra 30
jobbra negyed
elore 70
balra negyed
Ping hang lejátszása a végéig
felnyit-lezar
balra negyed
elore 58
balra negyed
elore 25
Hello hang lejátszása a végéig
felnyit-lezar
hatra 25
balra negyed
elore 58
állj és kilépés a programból

#9 | Deliver school learning materials

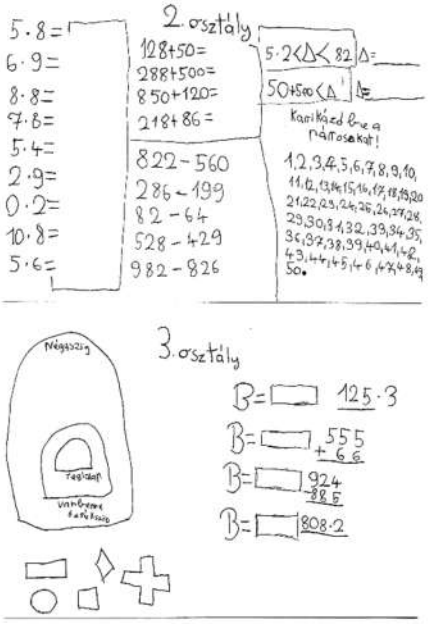


Kids in the hospital cannot go to school and can easily get behind their schoolmates' progress.

We see from several examples that if you can learn in the hospital, can get the homework, the progress and can follow then both your mental health and your rehabilitation will be faster.

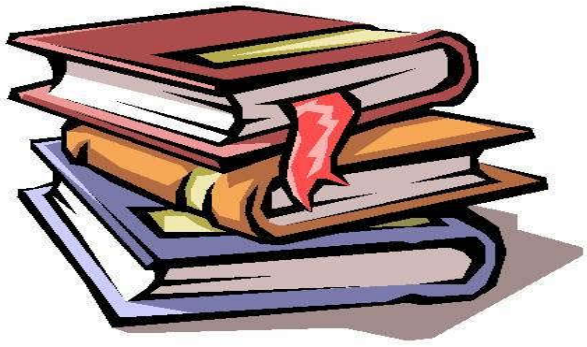
This reminds you to the school mates and school friends. That's why we think this functionality is a good idea similarly to the Kórházsuli foundation.

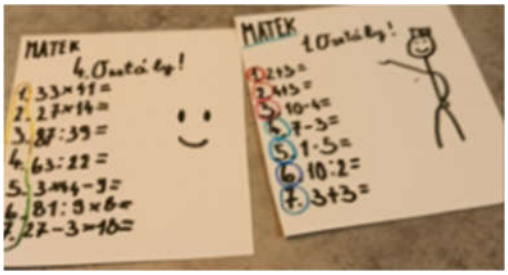
We are creating sample learning task cards for 1-2-3-4 grade kids as a sample and our robot (Hermione or even Luna) can deliver it to the selected kids.



Usage:

- Robot starts from the storage room
- Pick a room and a bed and determines which class the patient is in
- Robot picks up the learning card from the storage room
- Robot delivers the learning card to the appropriate room and places it to the bed
- Robot returns to the storage room





Social Impact and Innovation

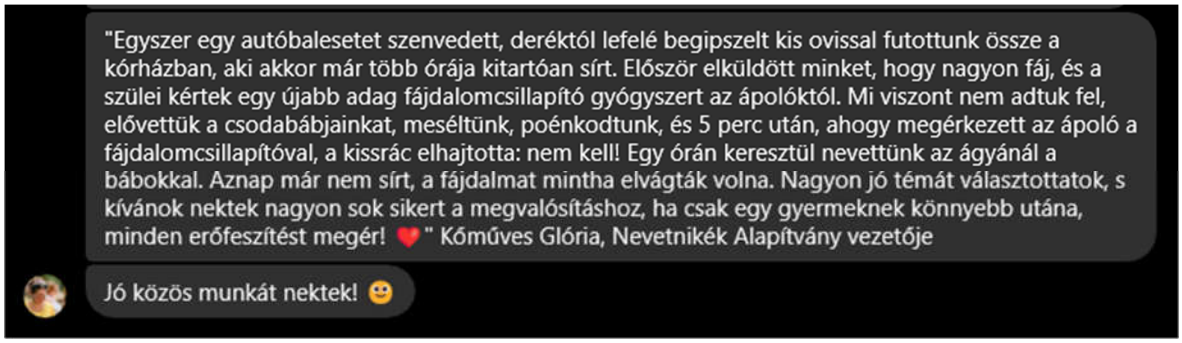
Many people all around the world gets hospitalized for shorter or longer periods. The hospital staff cannot spend as much time with them as they would need, unfortunately. When you are in a hospital and ones can pay attention to your mental health you can recover faster. Mental wellbeing includes socializing, entertainment, happiness, caring for others and ability to have mental focus. It is much easier to reintegrate to your normal daily routine after a longer illness if your mental wellbeing was taken care of. Sometimes recovery is faster if someone gives you a laugh.

Our solution can help anyone in the world who had to go to a hospital. Based on our questionnaire majority of responders felt loneliness in hospital. Our development of hospital social robot can provide a solution for this.

Here in Budapest, in the Bethesda Children Hospital there are lot of attempts to focus on mental recovery already, such as visit of helper dogs, therapy horse visit, clown doctors, fairy tale path in the garden of the hospital, etc.

Our solution complements these initiatives. Our robot would serve the small patients day and night. The kids could choose from several functionalities based on what they prefer at the moment most. Additionally - based on the questionnaire – our robot would help not only the entertainment, but also learning and school activities as well.

Glória Köműves, the Head of Nevetnikék Foundation from Pécs has ensured us that this direction is important for the faster recoverz of the patients.



Sources

We have used sources from the internet to understand more about hospitals

Internet

Begyűjti a mintákat, szállítja, válogatja, cimkézi	https://www.kuka.com/hu-hu/ipar%C3%A1gak/esettanulm%C3%A1nyok/2020/03/k%C3%B3rh%C3%A1z-4,-d-,0_kuka-laborrobtok-v%C3%A9rmint%C3%A1kat-v%C3%A1logatnak Honvéd kórházas video: https://www.youtube.com/watch?v=wxx2FlTBv0g https://adoc.pub/robot-robotika-a-laboratoriumi-riumi-gyakorlatban-avagy-labo.html
DaVinci Xi sebészeti robot FundamentalVR	http://drszaborobotsebesz.hu/index.php?page=robotsebeszet https://index.hu/techtud/2022/01/24/da-vinci-rendszer-orszagos-onkologiai-intezet-elso-robotsebeszeti-beavatkozas-magyarorszagon-kasler-miklos/
Smart Pacifier Monitors Electrolyte Levels	https://www.medgadget.com/2022/05/smart-pacifier-monitors-electrolyte-levels.html
mySugr Junior Tudatosság növelése, gyerek látja a saját vércukor mérőjét játékosítva segít	https://www.mysugr.com/en/
ElliQ	https://www.theverge.com/2022/5/25/23140936/ny-state-distribute-home-robot-companions-nysofa-elliq
Kórházsuli	http://aranyanyu.hu/dontosok/tothne-almassy-monika https://korhazsuli.hu/csapatunk/

We have received information from

- Dr. Tamásné Bese Nóra, Director or Communication and Public Relationship, Bethesda Children Hospital
- Köműves Glória Head of the Nevetnikék Foundation