
Don't worry be
HAPPI

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What is the Concept?

The St.Mary's CoE Primary School, Horsham, Project of "Don't Worry Be HapPi" is an innovative approach to support primary school children's mental health and wellbeing discreetly. It introduces a system where each child is given an RFID key-fob for identity. The children can then express their emotions by tapping the key-fob against check-in stations placed around the school, based on a range of five emotions. Each emotion is denoted as a number ranging from very sad to very happy, but this could also be tailored to accommodate other emotions (e.g. unhappy, confused, frustrated, etc).

This data is collected by a central Raspberry Pi, alerting teaching staff via the Teacher Module. The Teachers module features a physical dashboard which offers an instant, real-time view of the pupil's emotions. The module also features a graphical user-interface where the teacher can track moods over time, understand if a particular time of day is particularly challenging for a pupil or whether the mood of a particular child has suddenly started to change. Both real-time and historical data are also viewable from any other computer via a web-interface, so special needs staff can also review and analyse the results.

The concept aims to reduce social stigma and provide a safe means for children to communicate their feelings, potentially expanding to include panic buttons in private areas for urgent help or for when children simply don't know how to express how they are feeling. It also provides a safe avenue to children who feel unable or are too shy to express their feelings publicly. This idea is in response to the challenge of supporting mental health and wellbeing in educational settings post-COVID, recognising the significant impact these issues have on children's lives.

We incorporated insights from research documents into the HapPi project plan, we integrated key findings on the mental health impacts of the COVID-19 pandemic on children and young people, acknowledging the increased rates of probable mental disorders, sleep problems, loneliness, and the challenges of returning to school.

These documents highlight the critical need for supportive interventions like HapPi, emphasising the importance of providing a multifaceted approach to mental health support within educational settings, including:

1. The survey called "Young Minds Coronavirus Report Autumn 2020" highlighted the deteriorating mental health of young people during the pandemic, with many feeling unsupported upon returning to school. It emphasised the importance of routine, the positive impact of seeing friends and teachers, and the need for less academic pressure and more mental health support.
2. An NHS Survey called "Mental Health of Children and Young People in England 2021" reported increased rates of probable mental disorders, significant impacts on sleep and loneliness, and varying experiences based on demographic factors. It emphasised the compounded challenges faced by those with special educational needs and disabilities.

These insights underscore the importance of HapPi's aims to offer an inclusive, engaging, and supportive platform for children to navigate and articulate their emotional experiences, thereby enhancing their mental wellbeing. The project plans to incorporate mechanisms for early detection, support for sleep and nutritional health, and initiatives to reduce loneliness by fostering community and peer support. This comprehensive approach, informed by recent research, aims to mitigate the adverse effects of the pandemic and other stressors on children's mental health.

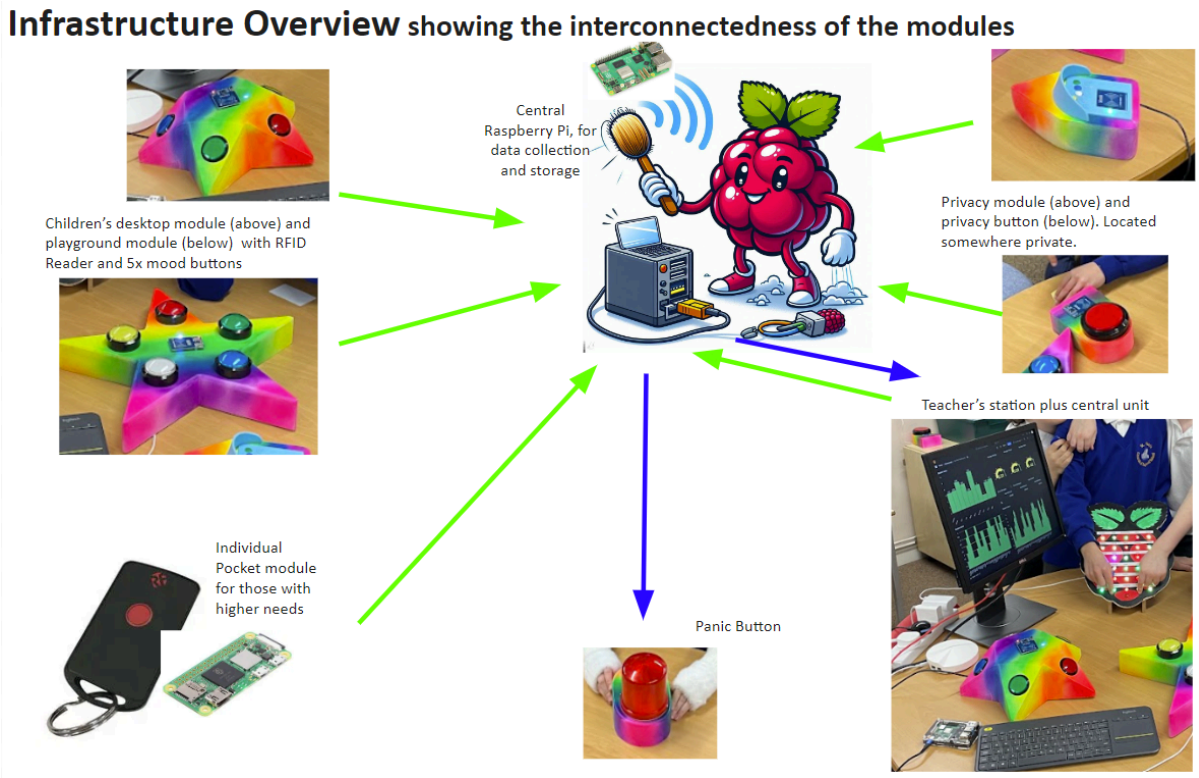
How does it work?

This innovative project aims to enhance mental health and wellbeing among primary school children by creating a supportive and interactive environment using Raspberry Pi technology.

The Project Goals included:

1. **Enhance Emotional Literacy**: Teach children to recognise and express their emotions constructively.
2. **Promote Mental Wellbeing**: Provide tools and resources for self-help and understanding, reducing stigma around mental health.
3. **Ensure a Supportive Environment**: Enable teaching staff to identify and support children who may be struggling, fostering a culture of care and inclusivity.

The below infrastructure overview highlights the interconnectedness of the various modules, and the purpose of each module is explained further.



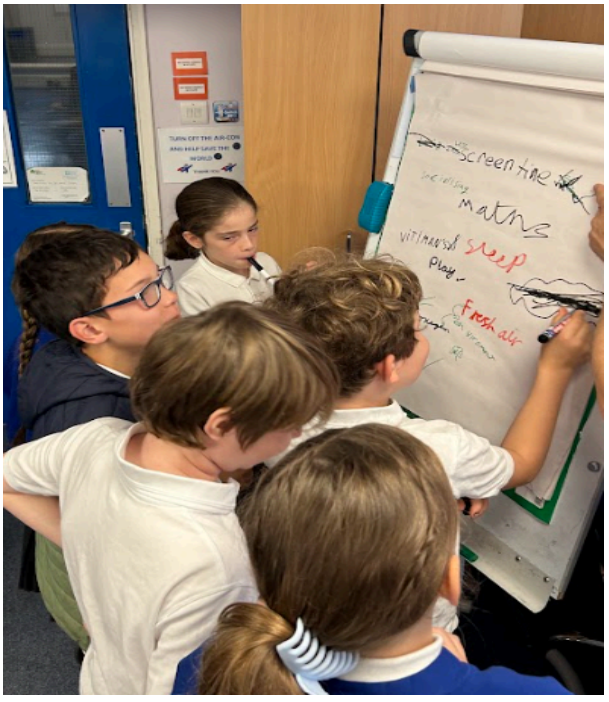
- **Teacher's module:**

    - The teachers module can receive the moods from the student and show class statistics.
    - It will have a dashboard connected to it displaying each pupil.
    - The teacher's station will also have an emergency button to seek urgent help if needed.
    - The teacher can extract mood data for each child and the classroom and extract trend data.
- **Children's modules (desktop and playground):**
    - The pupil station will have an RFID reader to identify the pupil and five buttons so that they can input their mood.
    - A privacy module for children who prefer to communicate their emotions privately.
    - Once clicked, the child's mood is sent to the teacher module.
- **Pocket module:**
    - A button to put in your pocket for selected children who might feel more anxious.
    - Each pocket module will be connected to a different pupil.
    - When it is pressed it will alert the teachers station with the pupil's name.

  (Note that the Pocket Module was not built during this project but it would function just like the privacy module, desk module or play ground module only without an RFID reader. As the pocket module would only be issued as a personal device to known children with specific needs, no ID reader is needed.)
- **Panic button:**
    - The panic button can be found on walls in private spaces and will alert the teachers module in case they are hurt or simply can't cope anymore.
    - It will have an RFID reader to identify the pupil that pressed the button.

Developing the Concept

The primary school kids developed the HapPi concept through brainstorming sessions and more brainstorming and more brainstorming sessions over many weeks. It sometimes felt all that we did was brainstorm!



They eventually decided on the key elements of their project and held two interviews with Mrs. Cole, from St Mary's CoE Primary School, Horsham, and teachers from a local high school, Tanbridge House School. These interviews and presentations allowed them to gather insights and feedback on the emotional and mental health needs within the school environment, leading to the creation of tailored modules like Pupil's Privacy Module, which was 3-D printed.

Interview with Mrs Cole from St Mary's CoE Primary School, Horsham

Their presentations to the schools and engagement with school authorities were useful feedback loops that resulted in refining the project's direction and ensuring it met the actual needs of their peers. And a little daunted at presenting to the teachers at the high school, but they rose to the challenge.

Interview with teachers at Tanbridge House School, Horsham.

We then explored technologies such as Scratch, Python, Microbits, API, Cloud Technologies and electrical circuitry to evaluate their potential for the project.

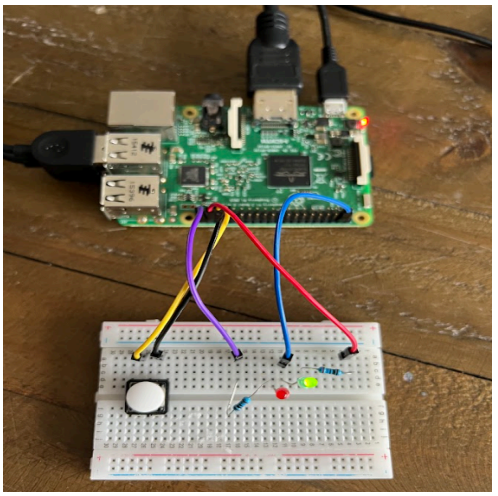
Once the concept was born, the team modelled their algorithms and modules on paper, to determine which technologies would be required by the project and devise a project plan.

Building the Project

The ideas were developed over many weeks of brainstorming. As the project progressed, we moved from concept to prototyping to actual building of the various modules. This required both the physical construction of the various modules and the coding for the RFID Readers and the Database Creation.

As a team, each of the pupils contributed and supported the project. They also reflect on their experience with some highlights included below:

Mimi:



- “I liked coding python and seeing how it all works.”
- “I liked coding python and seeing how it all works.”
- “I found brainstorming challenging as all the good ideas had been said!”

Lois:

- “I liked making the human circuit in class and spraying the modules as they were really fun.”
- “I like seeing something being made and working as part of a group.”
- “Python coding was the worst part.”

Lexi:

- “I like the experiment of the electrical current going through our bodies. And when I stopped holding Lois’ hand the current stopped.”
- “I enjoyed cutting the wood for the panic button.”

Cameron:

- “I liked soldering the headers onto the Raspberry Pi because I found it satisfying and I like learning new stuff.”
- “I learned python and soldering, which I liked because I had never done it before.”
- “I found coding in python really hard because I found it hard to memorise.”

Nic:

- “I enjoyed making the playground module and putting the lights into it. I liked soldering the wires onto it, but it was difficult.”
- “I learnt about circuits, rfid readers, programming the Microbit and learning how to code in python with the Raspberry Pi.”
- “It was hard measuring and cutting the bits of wood to make the modules look like nice stars.”

Seb:

- “I enjoyed sawing the wood to make the desk module and soldering the RFID together.”
- “The most challenging part for me was brainstorming the original idea.”
- “I learnt to code python which is a coding app.”

Set-up, Running and Operating the System

With the exception of the Teacher’s Station and the Data Hub, each of the modules were built using a Raspberry Pi Zero and the Raspberry Pi OS 32 bit, (Bookworm) LITE.
The Teacher’s Station and Data hub both used a Raspberry Pi 4 using the normal (non-LITE) Raspberry Pi Bookwork OS.

Set-up

The devices were set up as follows:

For the **Pupil’s module; Privacy Module (Boaty); Playground Module & Panic Button Module;** the OS was configured as follows:

1. Update and upgrade the computer:
   ```
   sudo apt update
   sudo apt update
   ```
2. Enable SSH and SPI from the interfaces menu in Raspi-config for remote management:
   ```
   sudo raspi-config
   ```
3. Set the hostname by editing both hostname and hosts:
   ```
   sudo nano /etc/hostname
   sudo nano /etc/hosts
   ```
4. Disable virtual environment requirement:
   ```
   sudo rm /usr/lib/python3.11/EXTERNALLY-MANAGED
   ```
5. Install pip3:
   ```
   sudo apt-get -y install python3-pip
   ```
6. Install the MariaDB dependencies:
   ```
   sudo apt install libmariadb3 libmariadb-dev
   ```
7. Install the mysql connector:
   ```
   pip3 install mariadb
   ```
8. RFID Reader: Enable SPI in Raspi-config:
   ```
   sudo raspi-config
   ```
9. Install the RFID library:
   ```
   pip3 install mfrc522
   ```

The **HeadTeachers Station** was similarly built with the following two additional commands:

1. Install the MQTT client:
   ```
   sudo apt-get install mosquitto-clients
   ```
2. Install the python MQTT libraries
   ```
   pip3 install paho-mqtt
   ```

The **Teacher's Station** was configured as follows:

1. Update and upgrade the computer:
   ```
   sudo apt update
   sudo apt update
   ```
2. Enable SSH from the interfaces menu in Raspi-config for remote management:
   ```
   sudo raspi-config
   ```
3. Set the hostname by editing both hostname and hosts:
   ```
   sudo nano /etc/hostname
   sudo nano /etc/hosts
   ```
4. Add the grafana APT key:
   ```
   curl https://apt.grafana.com/gpg.key | gpg --dearmor | sudo
   tee /usr/share/keyrings/grafana.gpg >/dev/null
   ```
5. Add the grafana APT repository:
   ```
   echo "deb [signed-by=/usr/share/keyrings/grafana.gpg]
   ```

```
https://apt.grafana.com stable main" | sudo tee
/etc/apt/sources.list.d/grafana.list
```

6. Install Grafana:
```
sudo apt-get update
sudo apt-get install -y grafana
```
7. Enable the Grafana server for automatic start on reboot:
```
sudo /bin/systemctl enable grafana-server
```
8. Start the server:
```
sudo /bin/systemctl start grafana-server
```
9. Disable virtual environment requirement:
```
sudo rm /usr/lib/python3.11/EXTERNALLY-MANAGED
```
10. Install pip3:
```
sudo apt-get -y install python3-pip
```
11. Install the MariaDB dependencies:
```
sudo apt install libmariadb3 libmariadb-dev
```
12. Install the mysql connector:
```
sudo pip3 install mariadb
```
13. Install the libraries for the addressable strip:
```
sudo pip3 install rpi_ws281x
sudo pip3 install adafruit-circuitpython-neopixel
```
14. Install the MQTT client:
```
sudo apt-get install mosquitto-clients
```
15. Install the python MQTT libraries:
```
pip3 install paho-mqtt
```

The **Datahub** was configured as follows:

1. Update and upgrade the computer:
```
sudo apt update
sudo apt update
```
2. Enable SSH from the interfaces menu in Raspi-config for remote management:
```
sudo raspi-config
```
3. Set the hostname by editing both hostname and hosts:
```
sudo nano /etc/hostname
sudo nano /etc/hosts
```
4. Install the MQTT broker and MQTT Client:
```
sudo apt-get install mosquitto mosquitto-clients
```
5. Run the MQTT broker to make it operational:
```
sudo systemctl enable mosquitto
```
6. Modify the configuration file to allow incoming messages from other machines:
```
sudo nano /etc/mosquitto/mosquitto.conf
```
and add the following two lines:
```
listener 1883
allow_anonymous true
```

7. Restart the service to enable the change:
   ```
   sudo service mosquitto restart
   ```
8. Install MariaDB as follows:
   ```
   sudo apt install mariadb-server
   ```
9. With the MySQL server software installed on the Raspberry Pi, we will now need to secure it by setting a password for the "`root`" user:
   ```
   sudo mysql_secure_installation
   ```
10. To access the MySQL server and start making changes to the databases, enter the following command:
    ```
    sudo mysql -u root -p
    ```
11. Create a database and table to store the entries:
    ```
    CREATE DATABASE StMarysSchool_MariaDB;
    ```
12. Create a MySQL user that we will assign to our new database:
    ```
    CREATE USER 'stmarys'@'localhost' IDENTIFIED BY '5ch00l##';
    ```
13. Now, grant all privileges to the database we created earlier:
    ```
    GRANT ALL PRIVILEGES ON StMarysSchool_MariaDB.* TO
    'stmarys'@'localhost';
    ```
14. Finally, flush the privilege table (Without flushing the privilege table, the new user won't be able to access the database):
    ```
    FLUSH PRIVILEGES;
    ```
15. Now enable the database for use:
    ```
    USE StMarysSchool_MariaDB;
    ```
16. Create the table with the needed data sets:
    ```
    CREATE TABLE students(
    record_id int auto_increment,
    device varchar(20),
    Student varchar(50),
    Status int,
    Time timestamp default current_timestamp,
    Primary key(record_id) );
    ```

All devices were assigned a static IP address for convenience, but the DataHub must be assigned a static IP address for the system to work, since this is referenced in the code.

Software

The software can be accessed using the following GIT repository:
https://github.com/somer750/StMarysPaPi2024
The code for each module must be copied to the relevant module and run from there.

Operation

1. Power the DataHub module first. The MariaDB database and Mosquitto MQTT system will start automatically.

2. Power the Pupil's Module, and start the python program:
   `python3 DeskModule00.py`
3. Power the Playground Module, and start the python program:
   `python3 playground00.py`
4. Power the Pupil's Privacy Module, and start the python program:
   `python3 boaty.py`
5. Power the Panic Module, and start the python program:
   `python3 panicbuttonR00.py`
6. Power the Pupil's Module, and start the python program:
   `python3 DeskModule00.py`
7. Power the Headteachers Module, and start the python program:
   `python3 headteacher.py`
8. Power the Teachers Module, and start the python programs:
   a. `python3 alarmbutton.py`
      This enables the script to allow alert the head-teacher if support is needed in the classroom.
   b. `python3 teacher.py`
      This enables the script to illuminate the pupil's status dashboard.
   c. Open a web-browser, and navigate to:
      `http://localhost:3000/`
      This opens the Grafana dashboard to access trends, current results, historical results and trends per pupil. It can also be navigated from any other connected device of computer by browsing for:
      `http://<IP address of teacher's station>:3000/`
9. Before the first start, each of the students will need to be issued a card. That card should be personalised to uniquely identify them. Each of the Pupil's module, playground module, panic button and privacy module can be used to write data to the card. Simply enter the following command via SSH:
   `python3 write_rfid.py`
   The python script teacher.py will also need to be modified to suit the class members:
   `nano teacher.py`

Project Video and Demonstration

The project video can be seen here: https://youtu.be/GVCu0PVdqq0
Or downloaded here:
https://drive.google.com/file/d/1gPCnjebA-qkRrXuKYKP5_oHoJMIWgcwR/view?usp=sharing

Required Hardware

Pupil Module in the Classroom

- 1x Raspberry Pi Zero £-
- 5x 45mm illuminated push-buttons £6.81
- 1x RFID Reader £1.90
- 1x Breakout circuit-board £1.91
- 1x ULN2003 Transistor Array £0.95
- Various resistors £0.15

Pupil Privacy Module in the Classroom

- 1x Raspberry Pi Zero £-
- 5x pushbuttons £1.20
- 1x RFID Reader £1.90
- 1x Breakout circuit-board £1.91
- Various resistors £0.15

Pupil Module on the Playground

- 1x Raspberry Pi Zero £-
- 5x 60mm illuminated push-buttons £8.10
- 1x RFID Reader £1.90
- 1x Breakout circuit-board £1.91
- 1x ULN2003 Transistor Array £0.95
- Various resistors £0.15

Pupil Panic Module

- 1x Raspberry Pi Zero £-
- 1x 100mm illuminated push-buttons £4.46
- 1x RFID Reader £1.90
- 1x Breakout circuit-board £1.91
- 1x ULN2003 Transistor Array £0.95
- Various resistors £0.15

Teacher’s Station

- 1x Raspberry Pi Zero £-
- 1x Red Panic Siren £5.59
- 1x pushbutton £0.20
- 1x Breakout circuit-board £1.91
- 1x TIP120 Transistor £1.19
- Various resistors £0.15

Teacher Module

• 1x Raspberry 4 1GB	£-
• 1x Monitor (ebay)	£24.89
• 1m RGB Addressable Led Strip	£6.30
• 74AHCT125 Quad-level shifter	£1.30
• 1x Breakout circuit-board	£1.91
• Various resistors	£0.15

Data Hub

• 1x Raspberry 4 2GB	£-
Total:	**£61.85**

Future Opportunities

The team developed many more ideas and possible expansions of the system could include:

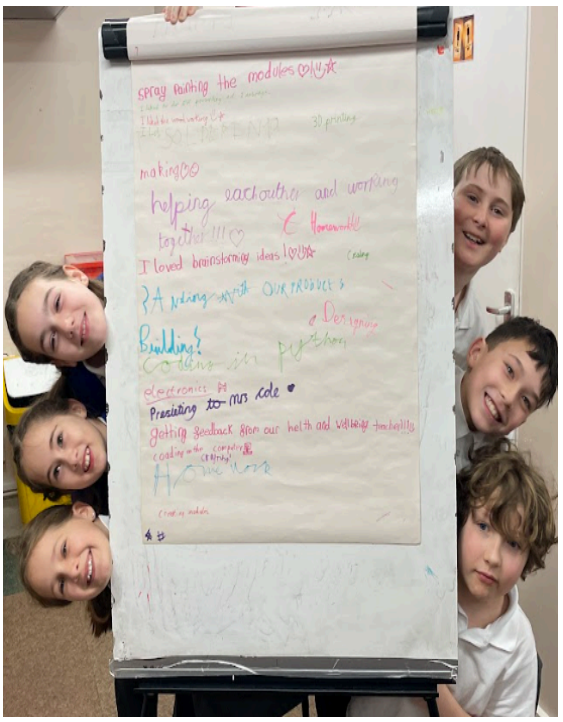
Expanding the HapPi project to include **parent and community modules** would integrate families and local resources into the mental health support network, offering a more comprehensive approach to student wellbeing.

The **Parent modules** could work by providing parents with access to a dedicated app or online portal linked to the school's system, where they can receive updates on their child's emotional check-ins, access resources for at-home mental health support, and receive tips on fostering a supportive environment at home.

Community modules could involve local mental health professionals and organisations offering workshops, talks, and activities, both virtually and in person, to educate and engage the wider community on children's mental health issues. This approach not only extends support beyond the school but also fosters a culture of openness and understanding about mental health, encouraging collaboration between schools, families, and community resources.

What the Team Learned

- **Brainstorming X 100!**
- Teamwork
- Perseverance
- How to use the Raspberry Pi
- Python coding
- Micro-bit coding
- Sensor technology
- Electronics
- Soldering
- Carpentry
- Listening to each other
- Expressing yourself
- Problem solving
- Product design
- Storyboarding
- Research
- Did we say, **Teamwork**!



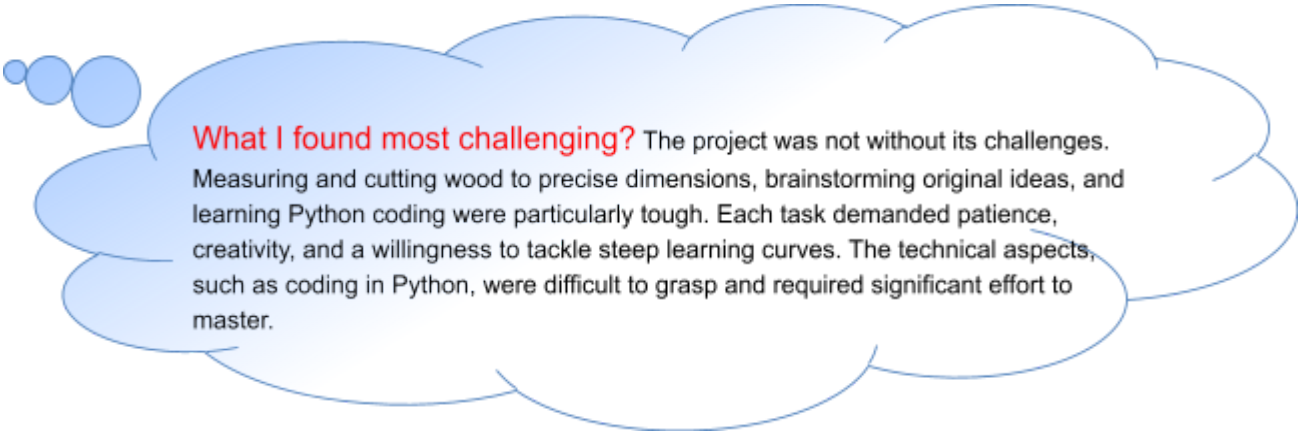
Highlights

The kids really dove into this project, brainstorming cool ideas and chatting with Mrs. Cole and the Tanbridge House School teachers to get their thoughts. Their project, HapPi, is all about using tech to make school a better place for students' mental health. And they found using Raspberry Pi both challenging and many “aha” moments, like capturing and recording the different pupil emotions (the colour changes on the Raspberry Student Dashboard).

Other key highlights include the cutting, glueing, painting, soldering, and coding of the Pupil Desk and Playground Modules and the Teacher's Module for real-time emotional state monitoring. Research documents emphasise the pandemic's significant impact on young people's mental health, underscoring the necessity for projects like HapPi. They've shown a ton of heart and smarts, putting together a proposal that's not only about helping their friends feel better but also super practical for everyday school life.

Reflecting on their experiences, the children highlighted “what I liked most” and “challenges I faced”:

What I liked most? The hands-on experience was a highlight for me. Making things like the playground module, soldering components onto the Raspberry Pi, and creating human circuits not only brought satisfaction but also a sense of accomplishment. Working as part of a group to see something being created from scratch was truly rewarding.



Conclusions

HapPi aims to create a more inclusive, supportive, and mentally healthy school environment. By leveraging Raspberry Pi technology, this project empowers children to understand and express their emotions safely, contributing to a foundation of lifelong mental wellbeing.

HapPi aligns with the Raspberry Pi competition's goal of using technology creatively to solve real-world problems. By focusing on mental health, this project addresses a crucial need within the school community, leveraging the versatility of Raspberry Pi to make a meaningful difference in children's lives.

References

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https://www.youngminds.org.uk/media/0h1pizqs/youngminds-coronavirus-report-autumn-2020.pdf