Spin & Purr

2024 Physical Computing Portfolio

Group 48
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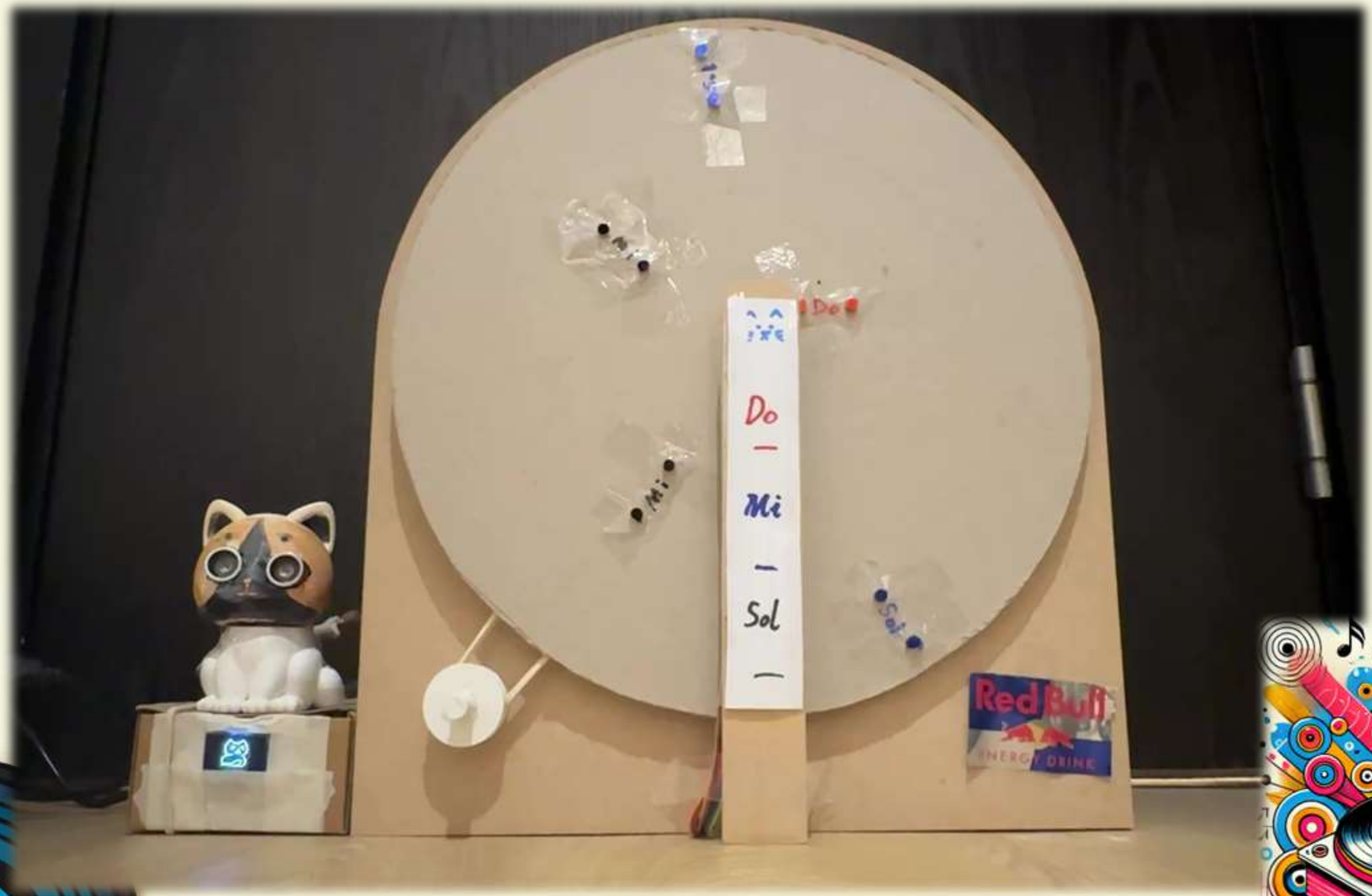


Functions

Kitty:

When you gently pet its head, the cat happily wags its tail as a sign of joy and affection.

Cats often crave human companionship and affection. They particularly enjoy being petted on their heads and under their chins.

When the screen displays this image, it represents the cat wanting to play and interact with humans.

When the brush strokes the cat's chin, this image on the screen indicates that the cat is feeling very happy and content.

When the head is petted gently by hand, the cat appears calm and obedient, as indicated by this image on the screen.

Record Player:

When the cat is in a good mood, the turntable starts to play music, mimicking how cats sometimes hum or purr when they are happy.

Randomly place rhythm magnets on the record to create and play the cat's humming-inspired music.

As the rhythm points pass the turntable, they play along with your voice, creating a delightful harmony. It feels as if the cat is joining you in a playful duet!

Bill of materials

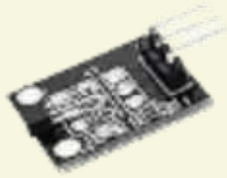
Appearance Component

Item	Details	Sourcing Method
6mm plywood board	Used for the base structure	Local hardware store
4mm cardboard	Gift box cardboard, used for decoration	Reused from received packaging
Rubber bands (2)	Elastic components	Stationery store
3D-printed bearings	Custom printed for rotational parts	ACX Workshop
PLA material (0.2mm)	Filament for 3D printing	ACX Workshop

Electronic Component

Item	Details	Sourcing Method
Bela board	Embedded system for control	ACX Workshop
Breadboard (x2)	Prototyping electronic circuits	Amazon
Arduino R3	Main microcontroller	Amazon
Audio out module	Sound output	Amazon
Jumper Wires (120pcs)	For connections	Amazon
Neodymium Magnets (x40)	For securing components	Amazon
AA Battery Holder (x4)	Battery holders with ON/OFF switch	Amazon
Hall Effect Sensor (x10)	Magnetic field detection	Amazon
OLED Display (x3)	128x64 resolution display	Amazon
Ultrasonic Sensor (x5)	Distance sensing	Amazon
Gear Motor (x4)	DC motors with gear reduction	Amazon
Breadboard Kit	Prototyping kit	Amazon
H-Bridge Motor Controller	Motor speed and direction control	Amazon

Details of Components



YOUMILE 10PCS KY-003 Hall Effect Magnetic Sensor Module 3144 For Arduino PIC AVR Smart Car

WATELL 40 Pcs Magnets, Neodymium Magnets For Whiteboard Strong Magnet Office and Home, 6x3mm Fridge Small Perfect Tools Fishing, Magnets Classroom, Silver

4 Pack Strong Magnet, 30 x 3 mm 8 KG Pull Super Strong Neodymium Disc Magnets, Magnets Strong with Double-Sided Adhesive, Powerful Permanent Rare Earth Magnets

EPLZON HC-SR04 Ultrasonic Module Distance Sensor fit for Arduino Robot XBee ZigBee (Pack of 5 pcs)

XTVTX 3PCS 0.96 Inch OLED Module 12864 128x64 Driver IIC I2C Serial Self-Luminous Display Board Compatible with Arduino PI (Blue and Yellow)

120pcs Multicolored Dupont Wire, Jumper Wires, Dupont Breadboard Ribbon Cables, 40pin Male to Male, 40pin Female to Female, 40pin Male to Male Breadboard Jumper Ribbon Cables Kit, Compatible for Arduino

4PCS AA Battery Holder with Cover AA Battery Holder Case with ON/OFF Switch 1.5V, 4 x 1.5V Series DIY Battery Storage Boxes, 4 Slots Black Plastic Batteries Case for AA Battery

HUAREW Breadboard Kit with Power Supply Module, Jumper Wires, Battery Clip, 830 & 400 tie-Points Breadboard

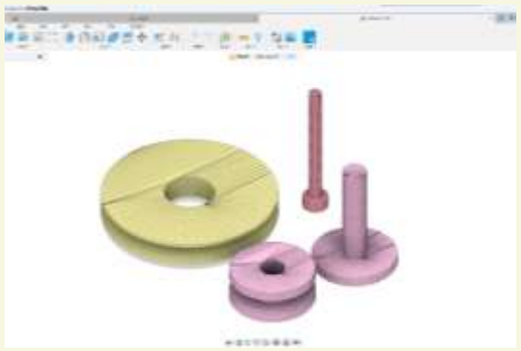
JYUDAFU 4 Pcs TT Motor DC 3-12V 1A Gear Motor Dual Shaft 200RPM Ratio 1:48 EMC Electric Gear Motor with Wire

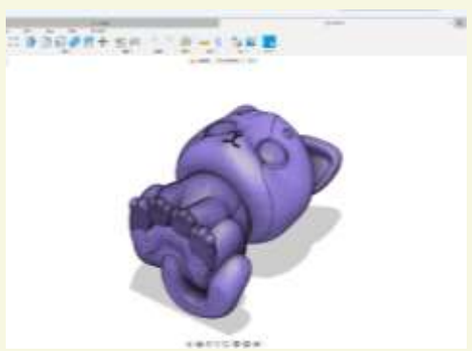
Production Process

Where Music Meets Feline Charm---

One day, my cat tapped an old vinyl record on the table, sparking an idea. Cats connect with us through gentle gestures, and mine always hums softly when music plays. This inspired the "Cat Turntable"—an interactive device blending music and feline emotions to strengthen our bond.

3D Printing:





The cat's shell needs to be scaled up by 1.5 times to accommodate the ultrasonic sensor, whose outer diameter is 4cm. The larger roller has a diameter of 5cm, while the smaller one is 2cm, achieving a high gear ratio. This allows the DC motor to rotate the turntable effectively while reducing the speed, making it easier to trigger the Hall sensors accurately.

Arduino

The Arduino is used to manage the physical movement of the turntable, wagging of the tail, screen display based on interactions.

Bela

The Bela platform is responsible for playing music, leveraging its capability to store and output high-quality audio files, ensuring immersive sound experience.

Shell:

The cardboard box used for the structure is repurposed from a class project, promoting sustainability. Additionally, the top cover is creatively made from an Amazon delivery box, emphasizing resourceful reuse.

Record Player:

The turntable is made from 4mm cardboard and 8mm composite wood, with a diameter of 32cm, while the machine's base has a diameter of 34cm.

Tools Used:

Hot glue gun
was used to securely attach the DC motor and assemble the components of the turntable, ensuring stability and durability.

Angle grinder
was used to precisely sand and shape the circular edges of the turntable, ensuring smooth and accurate dimensions.

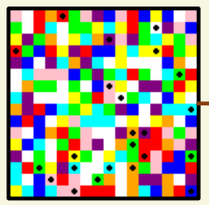
Handheld drill
was used to create precise holes in the outer casing, ensuring proper placement for components like sensors and wires.

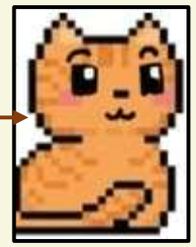
Chop saw
precisely cut the composite wood into the required shapes and sizes for the turntable structure.

Challenge and Solution

Challenge

Solution





Initially planned to combine multiple 8x8 color blocks to achieve a 128x128 screen display, but the Bela board could not load Arduino libraries. Switching to Arduino failed due to insufficient memory.

Shifted to designing an electronic pet, leveraging hardware limitations and achieving a unique and interactive feature through simplified design.

Originally intended to install an ultrasonic sensor internally for a concealed design, but sound waves could not transmit effectively, affecting sensor performance.

Drilled holes to expose the sensor probe, ensuring effective signal transmission, and learned to adapt designs to practical challenges quickly.

Since the Arduino cannot store images and my goal was to operate independently without a computer, it was initially impossible to display the cat image on the screen.

By converting the images into code, I was able to utilize the Arduino's 2MB memory to store the images, making it possible to display them on the screen.

Using an MP3 module and speaker for sound playback resulted in poor audio quality, increased power load, and added complexity to the program.

Replaced with a Bela board as the core, designed a record player structure, and leveraged its superior audio processing capabilities for high-quality sound, enhancing the overall experience.

Wood resistance and gravity caused power supply issues for the DC motor, leading to unstable operation. The Arduino was overloaded with connected components.

Added a 6V battery module for independent motor power, reducing the burden on the Arduino, ensuring stable motor operation, and smooth functionality.

Needed to meet sustainability requirements by minimizing material waste and optimizing resource utilization.

Repurposed the Bela box as the motherboard casing, used Amazon packaging as part of the cover, created record stands from recycled bottle caps, and utilized leftover cardboard and aluminum tubes, combining functionality with a unique aesthetic.