

Pet Lovers: Intelligent Pet Feeding Machine

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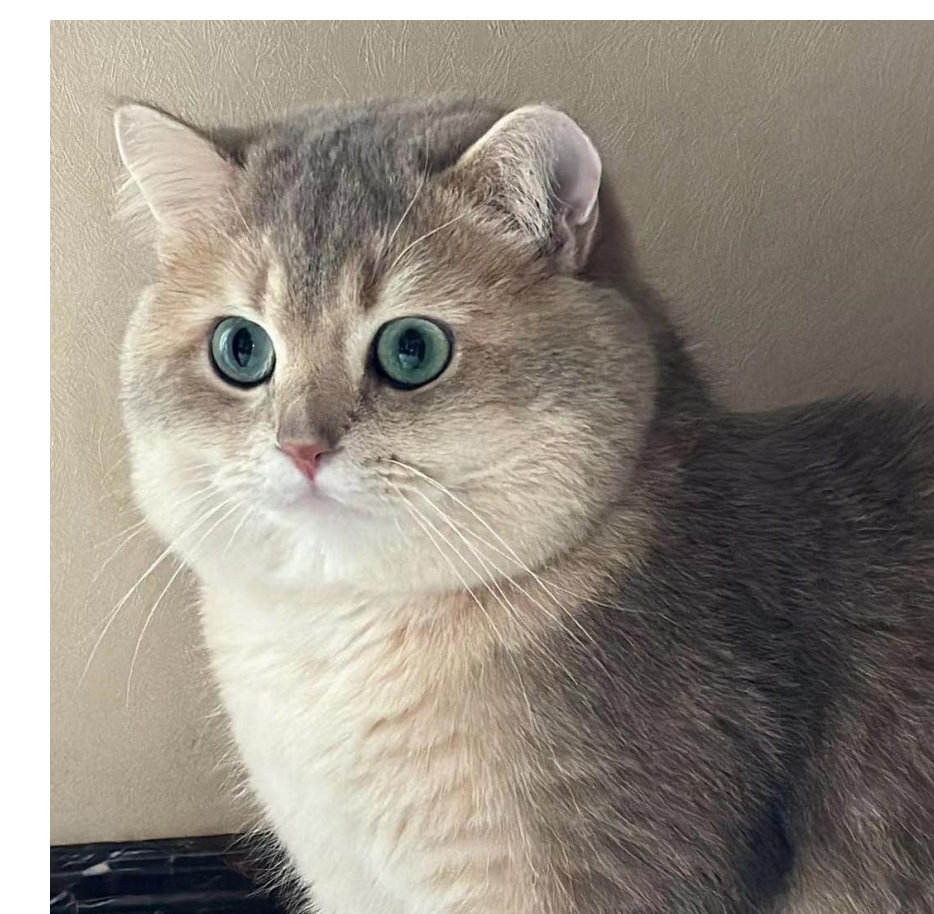
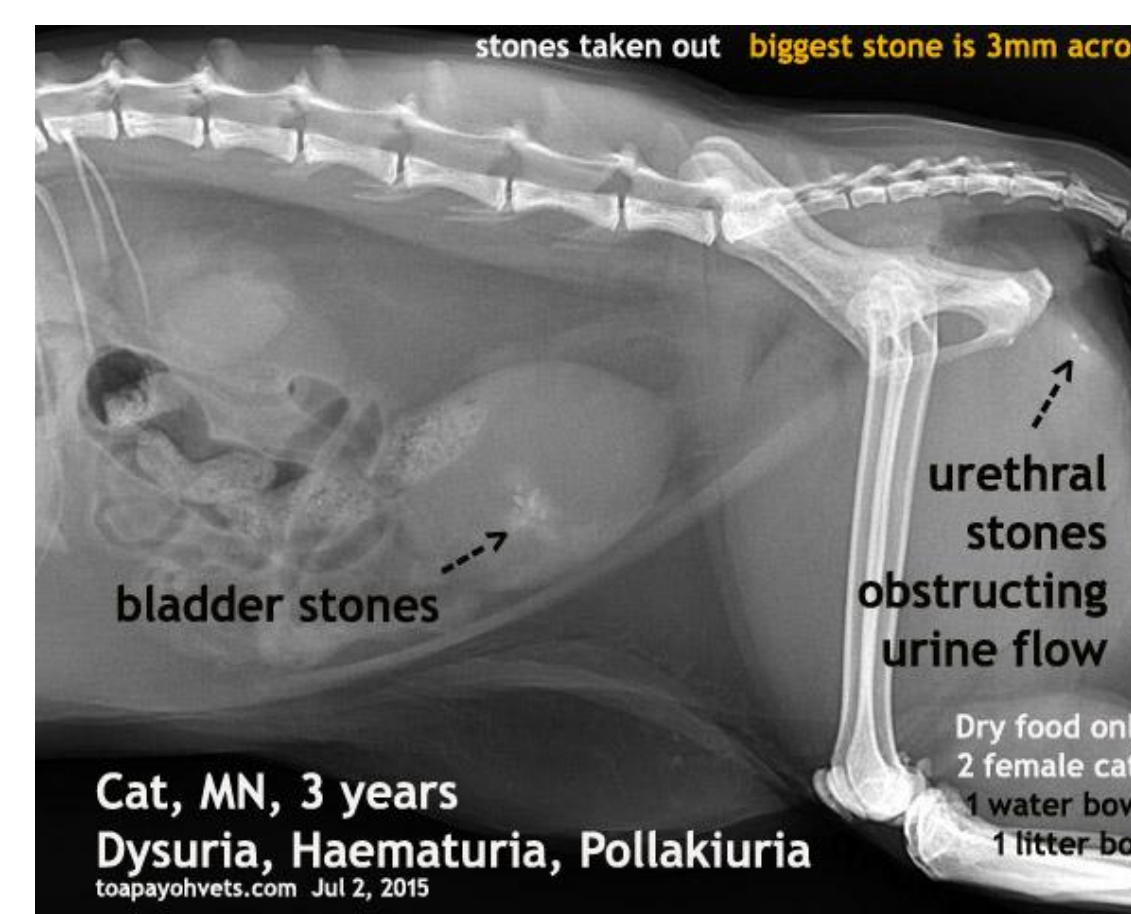
Quantitatively Analyze Pets' Daily Behaviors

Background:

- Some pets eat too much or drink too little water, which lead to serious diseases like obesity and bladder stone
- New pet owners can not detect potential illness of their pets because they are not familiar with pets' behavior
- Sometimes owners can not feed the pets regularly (working, traveling)

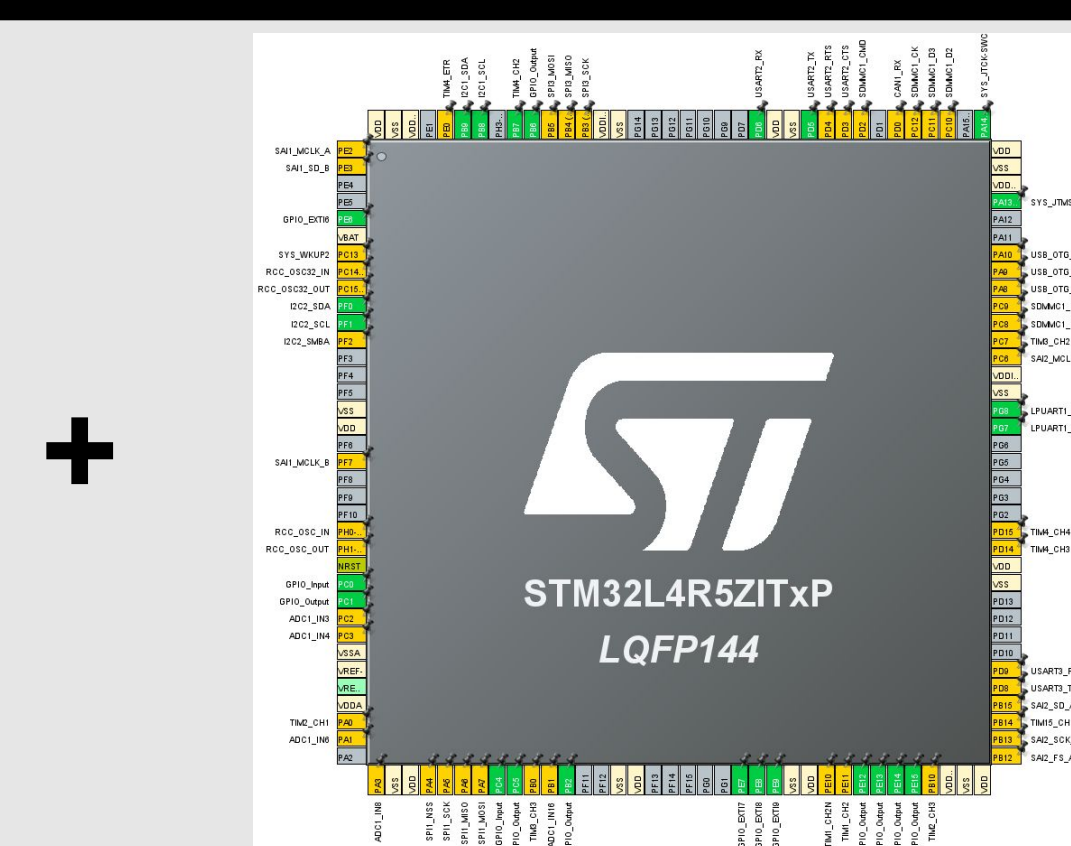
Value:

- Feed pet automatically when pet owners are not at home
- Keep track of pets' behaviors, and give warnings / suggestions based on previously recorded data



Add Intelligence to a Pet Feeding Machine

- Mechanical structure is similar to products on market
- Utilize periodic timer interrupt, load, humidity and temperature sensors to track pets' behavior
- Analyze data and provide advice with STM32 Nucleo
- User interface (OLED screen and keypad) where owners can select functions and read suggestions



Functions and Structure

Feeding

- Steering food container
 - 6-grids cylindrical food container
 - Rotates 60° each time
 - Driven by a 360° parallel servo with PWM controlling the speed
 - Releases food into the bowl both manually and automatically
- Water pump
 - 12V DC dosing pump and pipe
 - H-bridge controls flow direction
 - Water tank

Processor and Memory

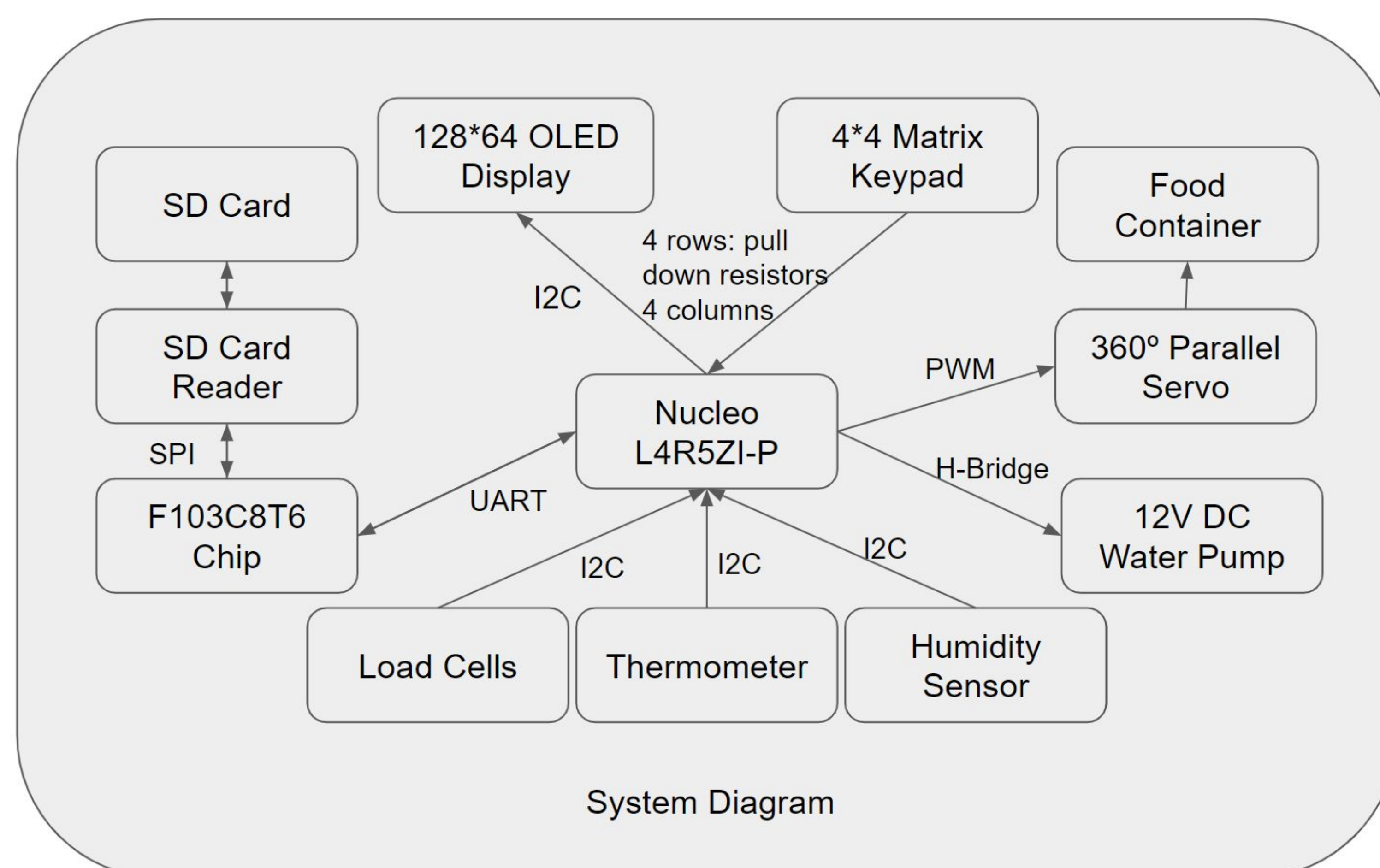
- SD card
 - Records food, water consumption and pet weight every day for further analysis
 - Read and write SD card^[1] by FATFS
- F103C8T6 Chip
 - Read and write to SD card via SPI
 - Full-duplex master for SD card reader
 - Full-Duplex communicate with Nucleo through UART
- L4R5ZI-P Nucleo board
 - Controls other components
 - Processes the data from sensors
 - Provide suggestions and warnings
 - Use periodic timer interrupt to feed automatically and store data daily

Measurement

- Load cells
 - Two 1 kg load cells weigh the pet food and water respectively
 - A 20 kg load cell weighs the pet
 - When force applied, the metal bar deforms and changes the resistance
 - Outputs to 24-bit ADC HX711 which amplifies the resistance change
 - HX711 output is linear to weight
 - Nucleo reads HX711 through I2C
- Temperature and Humidity Sensor
 - Help determines if the water or food goes bad
 - Transmit to Nucleo via I2C

User Interface

- 4*4 matrix keypad
 - Switch between modes: automatic feeding, manual feeding, monitoring, calibration and data display
 - Press-triggered interrupt
 - Implement each function in callback
 - User calibrate load cells with keypad
- 128*64 OLED
 - Displays the user interface, measured data and history
 - Displays suggestions and warnings
 - Driven by SSD1306 chip
 - Utilize a font library^[2] on GitHub
 - Communicate with Nucleo via I2C



[1] <https://embetronicx.com/tutorials/microcontrollers/stm32/stm32-sd-card-interfacing-with-example/>

[2] <https://github.com/afiskon/stm32-ssd1306>