ECE 4180 Final Project Proposal – One Proposal per Team

Team member 1: ___**Omar Jafar**_____ Section: ____**B**_____

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Please answer the following questions about your final project:

What microcontroller and peripherals are you going to be using? Explain what each peripheral is going to be doing. If you need to order a part, please include it here along with a link of what needs to be purchased.

Microcontroller: ESP32-C6 Dev Board

Peripherals

- **uLCD/TFT Display (SPI, 1.44–2.0 in, 128×128 or 240×320)(Digital Output)**
  A small 1.44–2.0 inch screen that shows the character "BMO," its status bars (hunger, energy, happiness), chat interface, and mini-games.
- **Five Tactile Push Buttons (GPIO with Interrupts)(Analog Input)**
  (Up, Down, Left, Right, Select). Used for menu navigation, playing mini-games with BMO to make him happy, and confirming chat prompts with BMO.
- **Joystick (Optional)(ADC)(Analog Input.)**
  Provides smoother navigation in menus and movement control in mini-games.
- **Buzzer or 0.5–1W Speaker + I2S amplifier (PWM or I2S)**
  For playing simple sound effects for notifications and games. If we choose to use I2S amplifier (MAX98357A), we'll achieve higher quality audio output
- **Electret Microphone Preamplifier (Optional)(ADC)**
  For a future update where the user can talk to BMO. The initial version will use text-based chat.
- **IMU Sensor (I2C)**
  Detects shakes or tilts to wake the device or cheer up BMO. Can also unlock hidden gestures.
- **WS2812 RGB LED or discrete LED (GPIO/PWM)**
  Displays BMO's mood through a light indicator and provides visual notifications.
- **Battery system**
  3.7V LiPo, charge module, 3.3V regulator, power switch. Enables portable gameplay

What is the purpose of your final project? Does it solve a specific problem? Make a user's day more convenient? Or is it a game for people to play?

We're building a pocketable "BMO" virtual companion. A Tamagotchi-style pet that lives on an ESP32-C6, plays mini-games, reacts to motion, and can chat through an on-device UI. The goal is to make a personable embedded system and have fun. Quick button interactions, simple games, mood light, and optional cloud chat make it a fun fidget toy.

Please provide any similar embedded systems/solutions that exist and how yours is different or improves upon it.

Similar products like the Tamagotchi and Furby offer virtual companions but with limited interactivity or closed systems. Our project combines their charm with modern embedded features. Using a color screen, motion input, and mini-games. Also, probably a chatbot functionality.

Using this table from the rubric, list which boxes you are going to use in your project and how:

<table>
<tr><td colspan="4">Score: Project Quality: default is 5 points per box unless stated otherwise up to 40 points</td></tr>
<tr><td>Digital Input

Five push buttons (Up, Down, Left, Right, Select) will control the UI, pet interactions, and mini-games.</td><td>Digital Output

The TFT backlight and an RGB LED will indicate BMO’s mood or alerts.</td><td>Analog Input</td><td>PWM Output or Analog Output

Buzzer or 0.5–1W Speaker + I2S amplifier (PWM or I2S)</td></tr>
<tr><td>Serial Communication</td><td>SPI Communication

Used to drive the uLCD/TFT display and optionally an SD card.</td><td>I2C Communication

Connects an IMU sensor to detect motion (shake or tilt).</td><td>Battery Powered

Powered by a 3.7 V LiPo battery with a charging circuit for portability.</td></tr>
<tr><td>Threaded Program</td><td colspan="3">Bluetooth/Wi-Fi/ESP-NOW

Wi-Fi enables optional chat functionality between the user and BMO.

10 points</td></tr>
<tr><td>Save information to Non-Volatile Memory

Pet state and preferences will be stored in NVS to persist between reboots.</td><td>Machine Learning Aspect 10 points</td><td>Using a new part not covered in the labs</td><td>Interrupts

Button inputs will use GPIO interrupts for quick response.</td></tr>
<tr><td>Sleep Mode

The device enters light sleep after inactivity and wakes with a button press or motion.</td><td colspan="2">Uses Watch Dog Timer/

Real Time System</td><td>Wired ESP32 Communication</td></tr>
<tr><td colspan="4">Last 10 points come from my overall quality aspect, which will be typically 5 or above so long you follow the feedback given in the proposal</td></tr>
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