

Barett Bear: Service manual

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1. Abstract

The Barett Bear is an autonomous robot that is used for day-to-day companionship. The functionalities varies and can be added and removed by the user's taste but in this prototype the functionalities can be described as hugging, petting and talking.

2. User manual

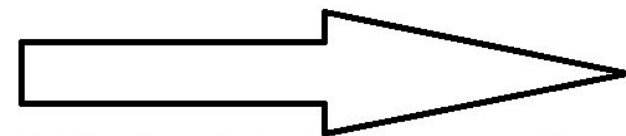
2.1 Turning on

To turn on the Barett Bear the user should turn on the black Switch which is located inside the back of the robot has to be toggled to On.



2.2 Turning off

To Safely turn off the Barett Bear, the Red-Button on the back of the robot has to be pressed followed by a 10 seconds waiting time before toggling the black Switch to Off.



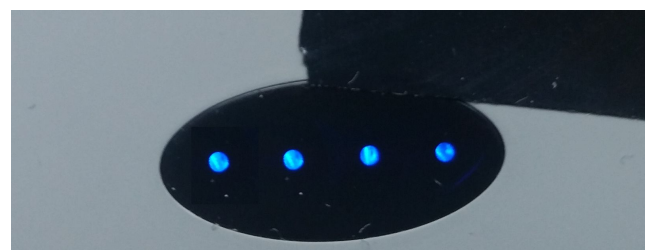
Wait 10 Seconds



Pressing the red button is the correct way to shut down the robot, where all data and files are safely stored to the memory. By pressing the black power switch directly may cause the microSD card to get corrupted.

2.3 Charging Batteries

In order to charge the bear, a micro-USB cable needs to be connected to the battery (Powerbank) on the back of the bear. Once all 4 leds on the Powerbank is lit up, the Battery is fully charged.



2.4 Pet

Gently pet (or apply pressure to) the robot on its head to make it activate the speakers outputting pre-defined sound. The robot is programmed to react to a solid pressure impact, therefore a too fast impact or nudge will not trigger the Pet sequence.

2.5 Hug

When embraced, by gently applying pressure to the Barrett Bear, the robot will move its arms inwards, making a hug gesture.

2.6 Voice Recognition

For the Voice recognition, Barrett Bear recognizes the words listed in its dictionary. The words have a different priority so when several words are recognized, the highest prioritized command will be executed before the lower priority command.

For example, If you say "Hello, It is a good morning" to the robot, it will respond with an answer: Good morning. Since 'Morning' has a higher priority than 'Hello'.

2.6.1 Voice Commands

Silence - When either of the commands "Silence", "Shut up" or "Quiet" is spoken to the robot, it should immediately mute itself until either of the phrases "Barrett", "Bear" or "Listen" is included in a sentence. Silence has priority number six.

Long conversation - When multiple defined phrases are recognized, Long conversation initiates and after the client stops speaking the bear will play a sound to encourage the client to proceed talking. Example of defined phrases:

Example of sound: "aha that is interesting" or "Go on"

Morning - When, the key phrase; "Morning" is spoken to the robot it should reply back by saying Good Morning, or some other appropriate phrase. Morning has priority number four.

Goodnight - When "Goodnight" is spoken to the robot pet, it should reply good night or some other appropriate phrase. Goodnight has priority number one.

Hello - When the key phrase "Hello" is spoken to the robot, it should answer back by saying Hello or some other appropriate phrase. Hello has priority number three.

Joke - When mentioning the word "Joke", the robot will recognize the word and tell you a randomly selected joke from its library.

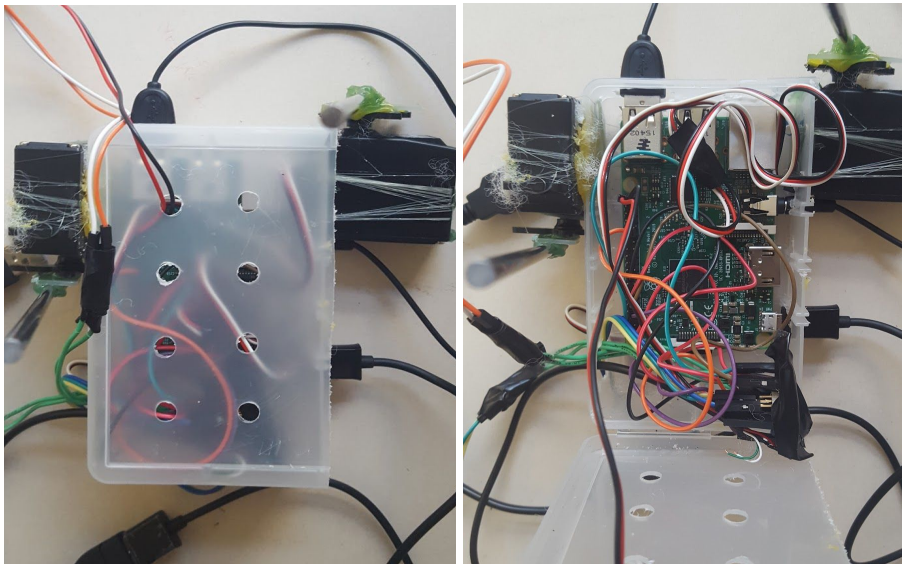
Food -

3. Materials and components

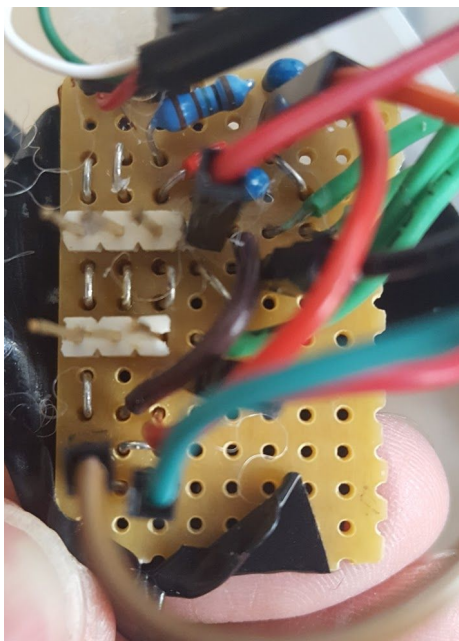
3.1 Components

3.1.1 Case

To hold all the hardware components fixed inside the embodiment and simultaneously protect them from physical impacts, the microcontroller and the circuit board were placed inside a custom made rigid plastic case. To this case the various components were connected by cables and some even glued firmly on to the case.



3.1.1.1 Circuit board



The circuit board works as a terminal between the components and the microprocessor where majority of the cables interconnects to this junction. The cables, pins, capacitor and resistors have been soldered to the board.

3.1.2 Arm

Two Parallax servos fastened to steel bars serves as the skeleton of the robot arm. One GPIO input pin is used for both servos on the RPi. As for the physical design, one servo is turned upside down and fastened to the hard plastic case to make the servos move inverted to the same destination on the same signal; like a hugging gesture. The hug is programmed to move in a rather smooth and slow hug inwards and move back in a faster pace.

3.1.2.1 Parallax Standard Servo #90

The servo works as a junction between the fixed case, which indicates as the body, and the permanently fixed metal bar, which indicates the arm. The Barett Bear's arms, that are controlled by the servos, hold any position between 0° and 180° and has 38-oz in torque at 6 VDC. The power each servo requires is 4-6 VDC.

3.1.3 Brown Teddy with rosette

A moderate sized, 35cm in height, brown cuddly Teddy bear stuffed with cotton with a golden rosette around its neck is used as the embodiment of the Barett Bear.

3.1.4 Microcontroller: Raspberry Pi 3 model B

A 64-bit processor with 1GB RAM-memory, the Raspberry Pi 3 model B, was used as the CPU for the robot. The microcontroller, together with the wired circuit board is protected in a plastic case to protect them from physical impact and other external contact.

3.1.5 Mini speaker Kitsound

A compact speaker powered by an external built-in rechargeable battery connected via the 3.5mm port on the RPi is used for sound output. The speaker itself is connected to one of the Raspberry Pi's USB ports for continuous electrical supplement.

3.1.6 Samsung Evo MicroSDHC 32GB

For storage of all the data and the software, we use a microSD card which has a capacity of 32GB and uses UHS-I interface. Its transfer speed is 48MB/s with UHS-I interface.

3.1.7 Square Force-Sensitive Resistor (FSR) - Interlink 406

Two square force sensitive resistors that vary its resistance depending on the pressure applied. The harder the force, the lower the resistance. FSR's voltage is from 0.1-5 V and current depends on the area. The area for the square FSR is 1.75x1.75 which is 3.0625 mA.

3.1.8 EnerPlex Jumpr Prime Power Bank 10400 mAh

For the power supply the Barett Bear uses a power bank with an electric charge of 10400mAh. The two ports, that can charge small USB-enabled devices, has a power output of 2.1A where both the Raspberry Pi's and the Parallax Standard Servo's power cords are connected to.

4. Software

The Barett bear is controlled through a program, written in high level programming language; python. The program is in the auto-start options for the operating system together with a small, separate program which enables the usage of the "safe shutdown button".

For the Voice Recognition Software, Jasper was chosen as the Barett Bear's platform. The STT (Speech-to-text) used is called Pocketsphinx, which is an offline package and serves well with embedded systems which are supposed to run without constant internet connection. In order to make the Barett bear more personal, a library consisting of multiple signed 16-bit wav-audio files were recorded and imported to the unit.

5. Appendix

5.1 Electric circuit diagram

