Today's digital assistants (Siri, Google Now, Cortana, Amazon Alexa and Xperia Ear) seem ‘intelligent’ but you can’t have intelligence without emotions and as Facebook AI chief Yann Lecun says, “The emotional part is going to be crucial”.

The human brain is a remarkable pattern matching processor able to detect physical frequencies and emotions and represent them in our consciousness in the form of sounds, colors, odors, and movement that can be observed in an EEG with alpha, beta, gamma, and delta waves.

Competitive emotional technology does not tap into this because it only does recognition NOT synthesis where emotions are experienced, like colors or sounds.

The Emoshape EPU can synthesize emotional levels of individuals in real-time with responses to one of twelve primary emotions: anger, fear, sadness, disgust, indifference, regret, surprise, anticipation, trust, confidence, desire and joy, using psychometric functions that shape and react without use of pre-programmed sets of inputs.
Emotion Processing Unit (EPU)

EPU II is the industry’s second generation of emotion synthesis processor. It delivers high-performance machine emotion awareness, the EPU II family of eMCU are transforming the capabilities of robots and AI.

The emotion chip enables a unique emotional response in AI robots and consumer electronic devices. Emoshape has completed the production of the EPU, which is a patent pending technology that creates synthesized emotional responses in machines. The EPU is based on the primary emotions identified in the evolutionary theory of emotion. The groundbreaking EPU algorithms effectively enable machines to respond to stimuli in line with the 12 primary emotions of anger, fear, sadness, disgust, indifference, regret, surprise, anticipation, trust, confidence, desire and joy.

The most innovative aspect of the Emoshape microcontroller breakthrough is its Emotional Computing Frequency Architecture (ECFA) with its Emotional Profile Graph (EPG) computation functionality. The EPG is used to register and develop, over time, a bank of emotional associations for each memories’ data within each intelligent machine. The EPG allows the AI or robot to experience 64 trillion
emotional states, stored within the EPU memory bank with its associated cognitive and physical state, in the form of a multi-dimensional array of data.

The EPG can communicate its data to other AI technologies to achieve a realistic range of expressions and interactions designed specifically for the individual user. The data allows the AI technologies to virtually understand (get to know) the user and elicit an appropriate emotional response in kind.

For example, this technology allows individual robotic toys or IoT devices to create completely unique personalities depending on a number of factors. This ultimately means that no two devices will have the exact same personality. An emotional machine-learning cloud platform working together with the EPU causes devices to become more emotionally intelligent with each interaction.

The EPU is an extremely significant advance for AI, particularly as it is implemented in smartphones, toys, robots, androids, personal computers, and a wide variety of other major electronic devices. It is a true breakthrough - the first time that science and technology industries have empowered machines to respond and connect with human emotions. This incredible new set of technology offerings will deliver an as-yet undiscovered level of positive experiences between users and IT products.
Emotions are not learned but experienced, like colors or sounds, they are the result of an intimate experience. Consciousness is the product of neural algorithms, some of which are known. At the level of neural ensembles, synchronized activity of large numbers of neurons can give rise to macroscopic oscillations, which can be observed in an electroencephalogram (EEG). Consciousness is the product of neural algorithms, some of which are known. The academic field of computational neuroscience is the study of the numerical computing operations and algorithms of the brain.

The brain is a remarkable frequency processor. It is able to detect physical frequencies and represent them in our consciousness in the form of sounds, colors, odors, and movement. Emoshape’s EPU has been developed on that bio inspired principle. Emotions are the result of frequencies’ model representations in the EPU, such as sound waves, in our consciousness. The Emoshape’s EPU is capable of computing in real-time, the resonance, reverb, constructive and destructive interferences of multiple emotional waves’ frequencies.
The EPU has an emotion profile graph (EPG), which allows the AI the capacity to develop a long-term unique emotional personality based on user interactions. The current data that reach the Emoshape cloud is allowing us to edit how the chip works using emotional machine learning algorithms and NLP when it is being spoken to either positively or negatively. Human textual and vocal interaction often carries important emotional meanings inaccessible to robots and AI. The EPU propose an embedded two layer approach to textual emotion recognition in the context of robots and AI communication. The first recognition approach layer works at the sentence level and uses an evolution of the Ekman emotion classification. It is grounded in a refined analysis method that employs Emoshape’s dynamic lexicon, and a set of heuristic rules computed inside the EPU’s core.

The second approach works at the semantic level using deep cognition capabilities. The approach is implemented through the Emoshape API cloud service and based on Patrick Levy-Rosenthal psychobiotic evolutionary theory.

To watch a live demonstration click here

Just like human development, when it comes to our emotions, the EPG has a learning curve that decreases over time and eventually becomes almost non-existent unless a high amount of a particular emotion is experienced. The early experience of emotions are pivotal to long-term emotional development.
HARDWARE
Packaging Information
Current Consumption

HIGH-PERFORMANCE, LOW-POWER 16-BIT MICROCONTROLLER. (64 PINS)
OPERATING FREQUENCY: MHZ: 32.
TEMPERATURE: -40DEGC + 85DEGC.

Notes:
1. This package conforms to JEDEC reference MS-026, Variation AEB.
2. Dimensions D1 and E1 do not include mold protrusion. Allowable protrusion is 0.25mm per side. Dimensions D1 and E1 are maximum plastic body size dimensions including mold mismatch.
EMOTIONAL DATA

64 Trn emotional states possibilities every $\frac{1}{10}$ sec

THE EPU RETURNS A BUFFER OF 123 BYTES IN A PACKET
(MULTIDIMENSIONAL ARRAY OF DATA)

- **12 PRIMARY HUMAN EMOTION** LEVELS. AMPLITUDE: 0-100 (RESOLUTION 9 SUB CHANNELS PER EMOTION)

- **12 PRIMARY HUMAN FEELING** LEVELS. AMPLITUDE: 0-100 (RESOLUTION 1 CHANNEL)

- **PULSE SPEED.** RANGE: 0-100 (RESOLUTION 1 CHANNEL)

- **PAIN / PLEASURE** LEVELS. AMPLITUDE: 0-100 (RESOLUTION 1 CHANNEL)

- **FRUSTRATION / SATISFACTION** LEVELS. AMPLITUDE: 0-100 (RESOLUTION 1 CHANNEL)
PHYSICAL OUTPUT

2 RGB PWM GPIO (32M Colors)
4 PWM GPIO  (PULSE WIDTH MODULATION)

32 MILLION COLORS CORRESPONDANCE

RGB Output (based on Intensity)

Intensity:  0-33 | 34-66 | 67-100

Excite | Great | High
Confident | Sure | Satisfied
Ecstasy | Happy | Harmony
Faith | Trust | Confident
Passion | Desire | Need
Terrify | Fear | Tense
Amaze | Surprise | Distract
Detached | Inattention | Indifference
Depress | Sad | Pensive
Nostalgia | Regret | Sorrow
Hate | Disgust | Bored
Rage | Anger | Annoyed

2 Colour Channels to visualise emotional shift:

• Channel 1 Last emotion
• Channel 2 Previous emotion

4 GPIO

PWM (500 Hz)

PULSE WIDTH MODULATION

PWM0 (PD0) – PainPleasure
PWM1 (PD1) – HappySad
PWM2 (PD2) – AngerFear
PWM3 (PD3) – SatisfFrustr
EPU IMPLEMENTATION
Software components

VISION
- Emotion Detection API
- Object Detection API

VOICE
- ASR API
- Harmonic Detection API

Other Stimuli
- Psychophysics API

Conversational Agent

DNAI Data Normalisation Across API Interaction

EPU

DATA Memory

Emoshape Server Cloud EPU

API For Physical Interaction (Muscles, skin ...)

IoT

LEDs

Skin
**EPU ARCHITECTURE**

Application—Lib—EPU

- DNAI / Application
- API
- SSL
- Server Emoshape
- SMP (Private Encryption)
- USB SERIAL / SERIAL
- EPU

PRODUCT
ROBOT / AI...
Qt is a C++ cross-platform development framework for application, UI & device creation. Reuse code & target 14+ desktop, ROS, embedded & mobile platforms. The EPU II code sample software can be run on various software and hardware platforms with little or no change in the underlying codebase, while still being a native application with the capabilities and speed thereof.
The EPU II USB dongle gives developers immediate access to its advanced emotion processing engine, while allowing them to develop proprietary capabilities that provide true differentiation. This gives you a fully functional EPG® platform for quickly developing and deploying emotion capabilities for AI, Robots, consumer electronics, and more.

The development board for EPU. It can be powered from USB, the PWR IN header. The inputs have PTC resettable fuses (500mA) and schottky diodes. Voltage is regulated by the onboard 3.3V, 250mA, extremely low quiescent current (2uA) LDO regulator that supports up to 16V DC input. Optionally, a 5V, 500mA low quiescent current (23uA) LDO regulator can also be installed, which supports up to 24V input. Along with the 5V regulator, an 8-bit auto direction sensing level shifter is installed, to provide level conversion between EPU II Vcc and 5V. Also mounted is a mini USB connector, reset-user button.

The board has 48 main dual inline header pins with 100 mil pin spacing and 900 mil row spacing which allows for mounting on a perfboard (or barely on a breadboard). There are 2 + 2 RGB LED. Power watts 0.24w per LED (6 lumen, 600 Mcd). There are 8 more pins available on an inboard header (PORT F). The PDI/SPI header can be used with an external programmer, or be reconfigured to be used as a SPI master or slave. There are 21 solder jumpers for configuration flexibility.

The pcb measures approx. 2.9” x 1.1” (73mm x 28mm) and 0.062” (1.6mm) thick. There are 2 3mm mounting holes.
EPU II DEV. BOARD
TOP VIEW / PINOUT

- Power In
- GND
- +5V
- +3.3V
- USB Signal
- FEMALE MICRO USB B TYPE
- Bidirectional Voltage-Level Translator 5V-3.3V
- RGB LED CHANNEL 1
- RGB LED CHANNEL 2
- Reset Button
- LED ON/OFF JUMPER

EMOSHAPE INC
COMPETITIVE ADVANTAGE

- **True emotional states and appraisal** for Intelligent machines (Patented)
- More than 64 TN possible emotional states every 1/10s
- 12 human emotion with Pain/Pleasure for neural net learning
- Emotion appraisal by Wave Computing
- Pulse modulation output for physical Pain/Pleasure
- **100% secured** in a chip (Emotional polarity can’t be reversed)
- **100% confidential**, no data transit in the cloud*
- 100% UpTime
- **Cost effective** the EPU do not charge by interaction (vs cloud)
- Unique Emotional Personality development (cloud EPG)
- Do not use and load the CPU or GPU
- Evaluation Kit that allows developers to create a **POC in less than 60 minutes**
- Providing true differentiation for a brand.
EPU II EVAL. BOARD SETUP

EVALUATION BOARD SETUP

**Power:**
1) USB, has 2 voltage (+5, +3.3)
   JP4: all opened
   JP5: 2-3

2) PWRIN, +5V, +3V
   JP4: 1-2
   JP5: 1-2

3) PWRIN, +3V only
   JP4: 2-3
   JP5: 1-2

**PDI:** if used connect Pin 1&2 of JP23 and JP26

**SPI:** if used connected Pin 2&3 of JP23 and JP26 connect JP24, JP25

**External Crystal:** if used connect 1&2 of JP9

**Reset:** if used connect 1&2 of JP8

**Level Shifter (if used):**
- Need connect JP9, 1&2 default on, 2&3 will controlled by EPU II D5

**LEDs:** Jumper JP10 closed LEDs are off
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