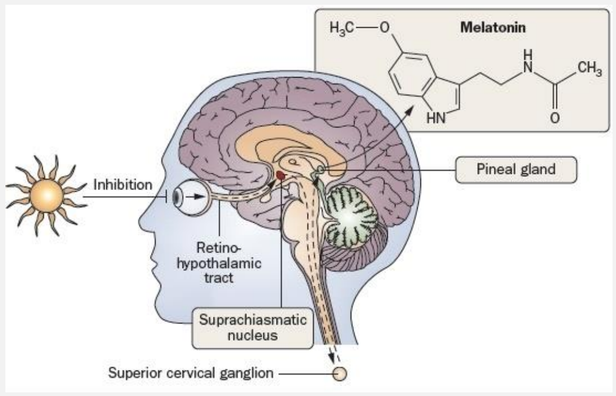
NeoPixel Sunrise Clock (NPSC)

An Intelligent Bedside Clock

BACKGROUND

Studies made on human behavioural patterns have revealed that light of $460 \pm 10nm$ wavelength can affect the sleep-wake cycle by controlling the production of melatonin.



OBJECTIVES

Create a device capable of generating light emission patterns which can produce both soporific and gentle awakening effects on humans, to control the human sleep-wake cycle in a more gentle manner that can have health benefits.

SYSTEM OVERVIEW

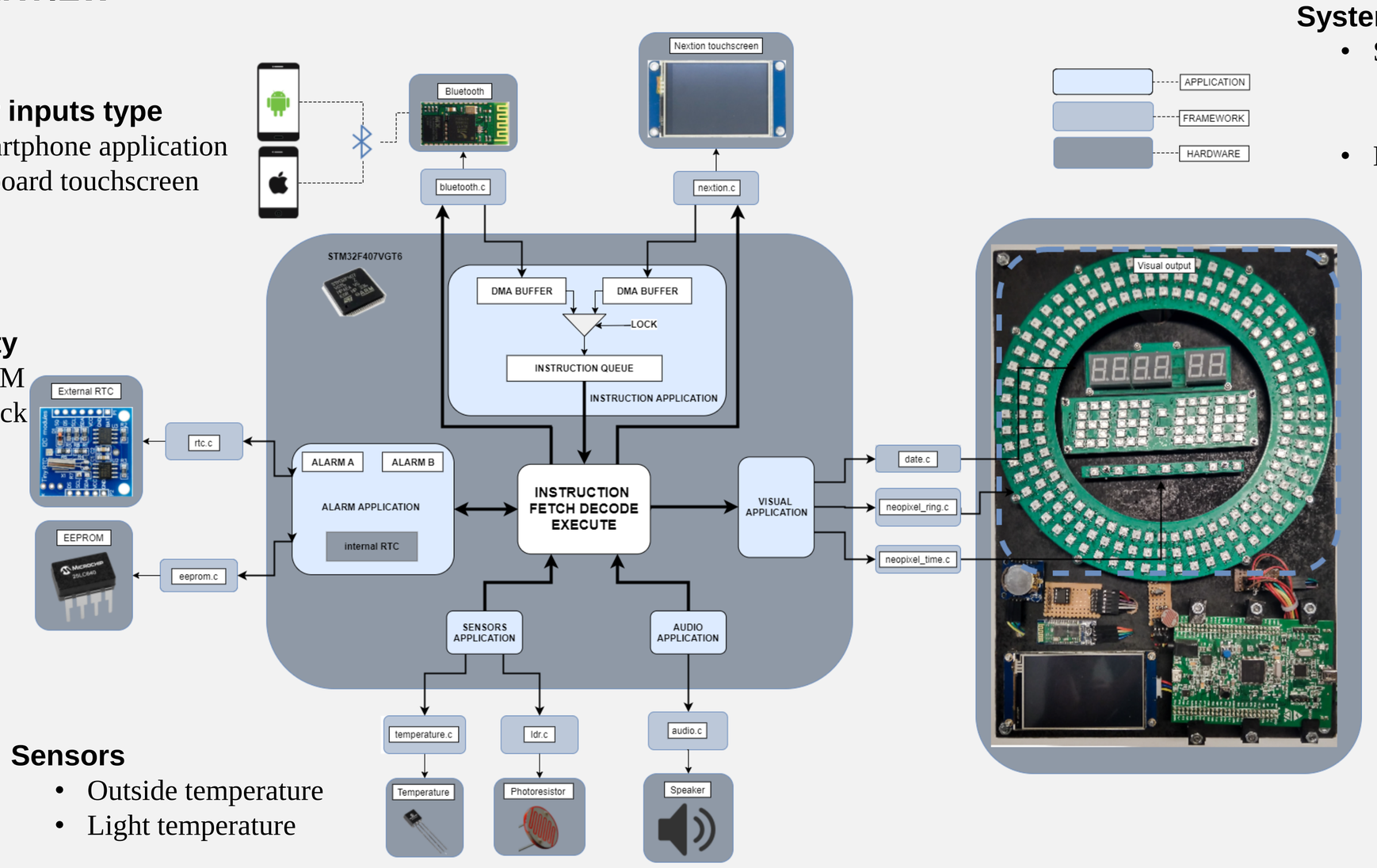
Two user inputs type
- Smartphone application
- Onboard touchscreen

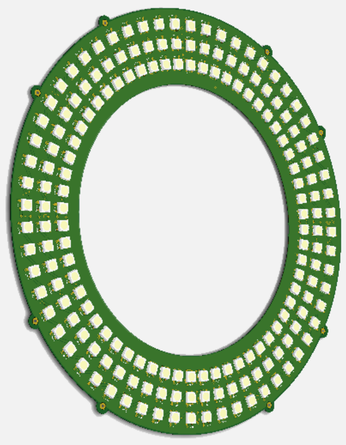
System Hierarchy
- Software
  - Application (top)
  - Framework (middle)
- Hardware (bottom)

Alarm functionality
- 64KB EEPROM
- Real Time Clock
- Alarms from

Sensors
- Outside temperature
- Light temperature

Visual outputs
- Ring for emitting light of $460 \pm 10nm$ wavelength at $30lx$
- Time & Weekday
- Date & Temperature





RING SPECIFICATIONS

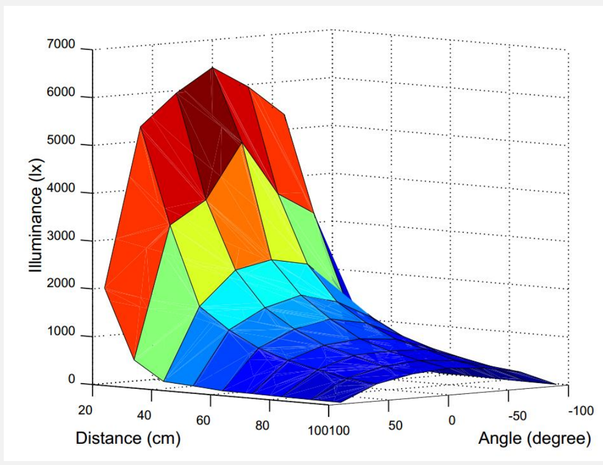
- 180 neopixels
- 5V @ 7.5A max
- 37.5 W max
- 0.5W min
- 21 x 21 cm^2
- RGB colours
- 255 x 255 x 255 x 180 colour combinations
- Refresh rate >= 5.4ms

MATHEMATICAL MODELS

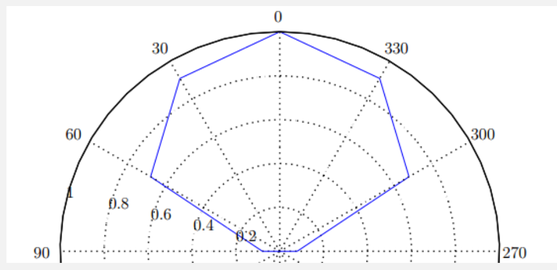
- Illuminance distribution as a function of
  - the distance (cm): $\mathbf{f(x) = 18.31x^{-1.53}}$
  - the brightness (%): $\mathbf{f(x) = 0.07043x - 0.0707}$
- Temperature (C) vs Current (A):
  - $\mathbf{f(x) = 6.57x + 3.46}$

ILLUMANCE AND BLUE LIGHT

Blue light of 465nm wavelength capable of significantly reduce the production of the sleeping hormone emit up to 30lx at an object place 1m meter away and at 90 degree angle from the normal to the Ring's surface.



Illuminance distribution of the Ring follows Lambert's Cosine Law. As expected, object positioned on the normal to the Ring's surface receive most of the illuminance emitted.



WHAT'S NEXT?

"Art is never finished, only abandoned." Leonardo da Vinci.

This piece of art can be improved in the following ways:

- Use the equations describing the behaviour of the Ring to design light patterns providing quantitative descriptions of the illuminance received by the user.
- Integrate the NPSC in the IoT device family

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