***Aim***: To take input from an accelerometer and light sensor (insert part names) and process into neopixel and LED output using an Adafruit Flora microcontroller, for a potential wearable warning and detection system.

***Tools***: Adafruit Flora V3

Adafruit LSM303 Accelerometer/ Compass Sensor

Adafruit TSL2562 Lux Sensor

Adafruit Neopixels

Wires with crocodile clips

Conductive thread

***Literature Review***:

<https://www.sciencedirect.com/science/article/pii/S0001457511002752>

Identify scope- anywhere reflective clothing could be used- this could be industry (exploratory work), cycling, construction

***Methodology***:

The accelerometer and lux sensor were connected independently and tested to trigger a response. The ***lux sensor*** input was bracketed into 3 different zones: low light (<= 20 lux), medium light/ room light (>20 and <400 lux) and bright light (>=400 lux). The ***accelerometer*** similarly was bracketed into 3 zones: stationary (<=0.5 ms-2), low speed (>=0.5 and <3 ms-2) and high speed (>3ms-2).

The light sensor triggers a response in the onboard LED’s blinking frequency. Low light triggers a blinking interval of 10ms, medium 1000ms and bright, 10000ms.

The accelerometer reading comes as a position in the form of 3 readings across an x, y and z-axis. To find a total acceleration reading, each individual reading is converted into a vector. The magnitudes of consecutive polled readings are subtracted in order to gauge an “acceleration” reading- or a change in the magnitude of the vectors.

Combining both sensors gives 9 possible combinations of light colour on the neopixels, as detailed in the tables below:

|  | ***Accelerometer*** | | |
| --- | --- | --- | --- |
| ***Lux sensor*** | ***1*** | ***2*** | ***3*** |
| ***1*** | A | B | C |
| ***2*** | D | E | F |
| ***3*** | G | H | I |

| ***Zone*** | ***Colour*** | ***R*** | ***G*** | ***B*** | ***Swatch*** |
| --- | --- | --- | --- | --- | --- |
| A | Pale Red | 255 | 204 | 204 |  |
| B | Burnt Orange | 204 | 102 | 0 |  |
| C | Red | 255 | 0 | 0 |  |
| D | Yellow | 255 | 255 | 0 |  |
| E | Green | 0 | 255 | 0 |  |
| F | Dark Green | 0 | 102 | 0 |  |
| G | Light Purple | 178 | 102 | 255 |  |
| H | Blue | 0 | 0 | 255 |  |
| I | Dark Purple | 76 | 0 | 153 |  |

***Pin Connections:***

***GND, SCL, SDA, 3.3V*** on Flora to ***GND, SCL, SDA, 3.3V*** Adafruit TSL2562 Lux Sensor

***GND, SCL, SDA, 3.3V*** (on opposite side) of Adafruit TSL2562 Lux Sensor to ***GND, SCL, SDA, 3.3V*** Adafruit LSM303 Accelerometer

***GND, #6, VBATT*** to ***-, inward arrow, +*** first NeoPixel

***-, outward arrow, +*** to ***-, inward arrow, +*** of next NeoPixel (s)

***Applications***:

To provide an ***alert*** system for workers in ***helmets*** and ***coveralls*** (***PPE***) that changes colour based on the speed of motion of the wearer and the lighting of the environment.

This would allow the wearer to be seen clearly in areas of low visibility, but provide more qualitative description of their status than, say, reflective material. Said material would only allow for identification of wearer given the light around them, the visibility of the reflective material, and the angle of the viewer. This Flora project however would give a distinctive colour, visible with no light around and regardless of angle.

This would allow a wearer to be identified regardless of existing lighting condition, and regardless of their state- upright, in motion, lying down- which provides an additional safety measure.

***Limitations:***

The durability of the system needs to be taken into consideration- electromagnetic interference in certain situations can be a problem, the lighting needs to be blastproof, the battery must be both secluded and sectioned.

*To be researched***:** lighting and battery considerations in different depths of the earth, around different electromagnetic interferences, temperatures, pressures etc.

Additionally, the lifespan against the cost of the technology must be considered. *What is the average lifespan of FRC coveralls? Would helmets make more sense?*