

Medical Physics (SBE1210)

Project 2

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Group 13

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Sanitizer Gate

Application Description:

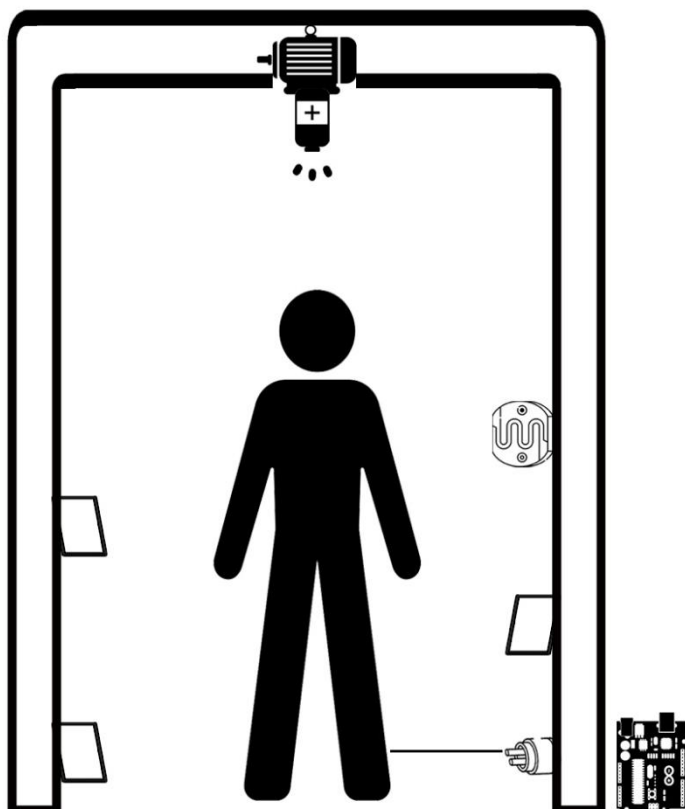
Our project is a gate that sprays sanitizer on the passer through it.

Using Arduino and light components, we will manufacture the gate to spray the suitable amount of sanitizer on the passer when he cuts the passage of the light ray (produced by the laser diode) that is reflecting successively on the mirrors and received by the LDR.

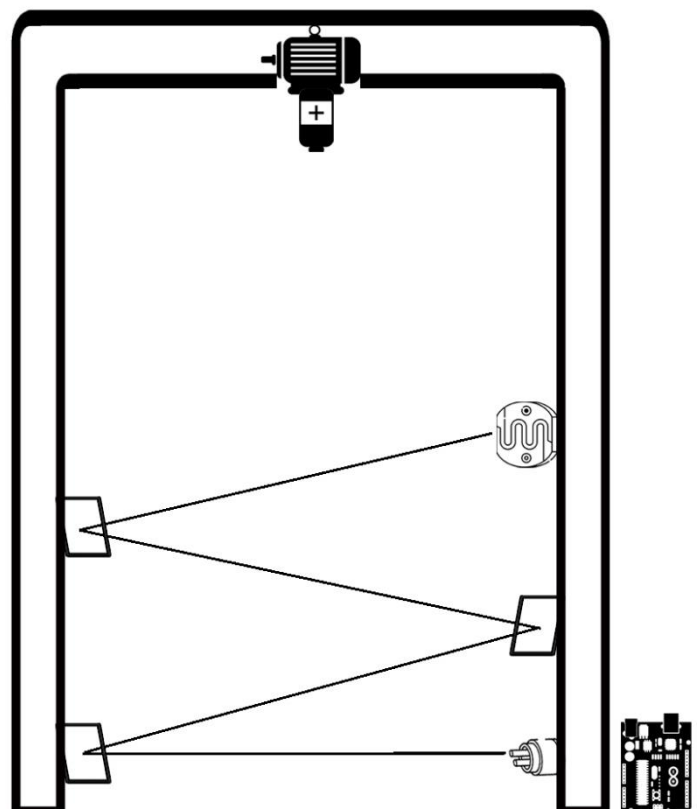
This project is very important Nowadays because of the high spread of Covid-19 and these gates are used in almost every public place.

Application Model:

When someone pass



When no one pass



Circuit Diagram:

Components used:

- 1- Arduino-uno
- 2- Laser diode
- 3- LDR
- 4- Three planar mirrors
- 5- Servomotor
- 6- Sanitizer bottle
- 7- Wires

Parameters related to light signal:

1- Light Dependent Resistor (LDR):

Illumination (fluorescent light)	500 lux
Resistance at 10 lux	8-20 k Ω
Power dissipation at 30°C	50 mW
Voltage AC or DC peak	100 V
Current	5 mA
Operating temperature rating	-25°C to +75°C

2-Laser diode:

Wavelength	650 nm
Divergence	>5 mRad
Optical Power	>5 mW
Input Voltage	3.5-4.5 V
Operating Current	5 mA
Operating temperature rating	-10°C to +50°C

Tissue Properties:

As our project is a demo of sanitizer gate, The laser beam will mainly interact with skin of human.

1-Absorption:

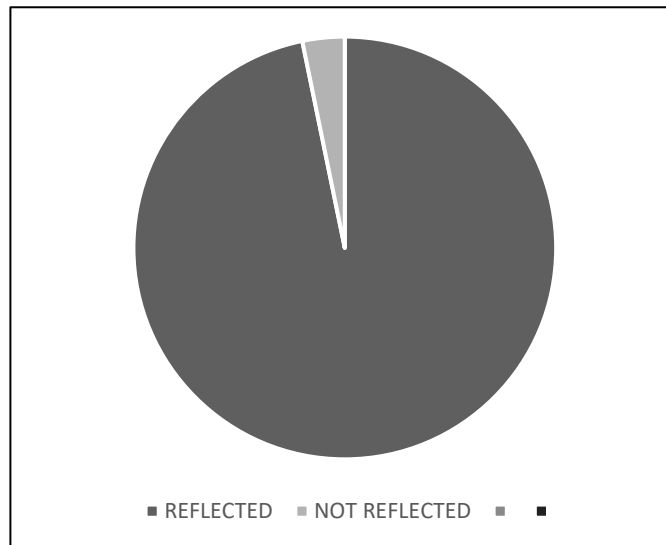
It describes a reduction in light energy. Within the visible region, there are two substances generally considered to dominate the absorption of light in skin: hemoglobin and melanin.

The average value of the absorption coefficient of skin was 0.066 mm^{-1} for $\lambda = 650 \text{ nm}$.

2-Scattering:

As well as Absorption, scattering contributes significantly to the appearance of skin. Scattering describes a change in the direction, polarization or phase light and is commonly portrayed as either a surface effect (such as reflection or refraction) or as interaction with a small region whose optical properties differ from its surroundings (particulate scatter).

The range of scattering coefficients of skin was (9.68-11.71) mm^{-1} for $\lambda = 650 \text{ nm}$.



Type of Light-Tissue interaction:

Reflection: Laser will keep reflecting till it reaches the LDR sensor or interrupted by a skin tissue.

Laser Mirrors: They are used in transmitting and manipulating laser lights.

Type of Optics used in the application:

The Optical component in our project is the planar mirror.

We used three planar mirrors for reflecting the laser beam many times on each mirror until it reaches the LDR sensor.

Laser mirrors are used because they are high-quality mirrors characterized by low reflection losses, high optical quality and good resistance against high optical intensities to avoid laser-induced damage.

Theory of Operation of Optics:

Reflection of light occurs when the waves encounter a surface or other boundary that does not absorb the energy of the radiation and bounces the waves away from the surface.

Diffuse Reflection: is produced by rough surfaces that tend to reflect light in all directions.

Specular Reflection: is defined as light reflected from a smooth surface at a definite angle.

When the laser is emitted, it will reflect successively to scan the area under the gate. If there is no one passing, the light ray will reflect successively until it reaches the LDR and nothing happens.

If there is a person passing, the light ray will be cut and no signal will reach the LDR so, the buzzer will produce a sound and also the suitable amount of sanitizer will be sprayed on the passerby.