ENGINEERING DESIGN-G3

-By

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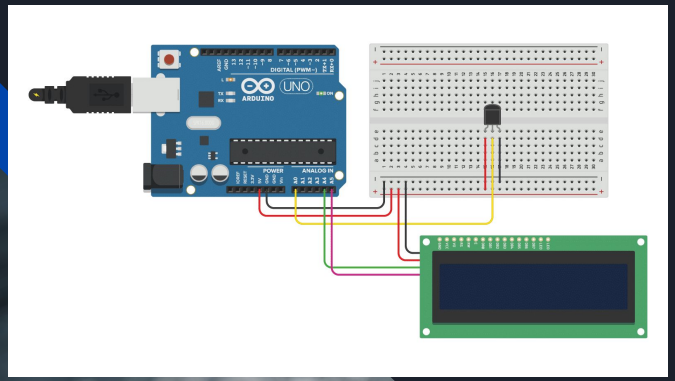
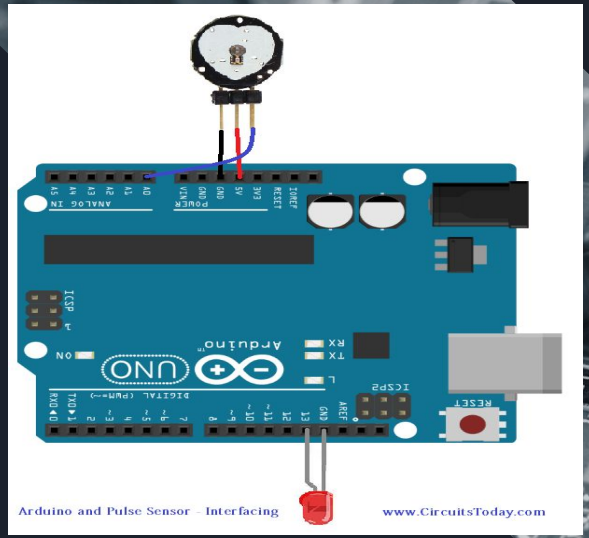
Health Monitor

Introduction -:
Health is always a major concern in every growth the human race is advancing in terms of technology. In mines it is always a better idea to monitor these Workers using remote health monitoring technology. So Internet of Things (IoT) based health monitoring system is the current solution for it.

Objectives -:
The core objective of this project is the design and implementation of a smart health tracking system that uses Sensors to track patient health and uses internet to inform in case of any issues.

Each of our bodies utilizes temperature and also pulse acknowledging peruse understanding wellbeing. The sensors are linked to a microcontroller to track the status which If framework finds any sudde changes in understanding heart beat or body temperature, the framew consequently alarms the client about the worker status over IOT and furthermore indicates subtle elements of pulse and temperature of worker live in the web.





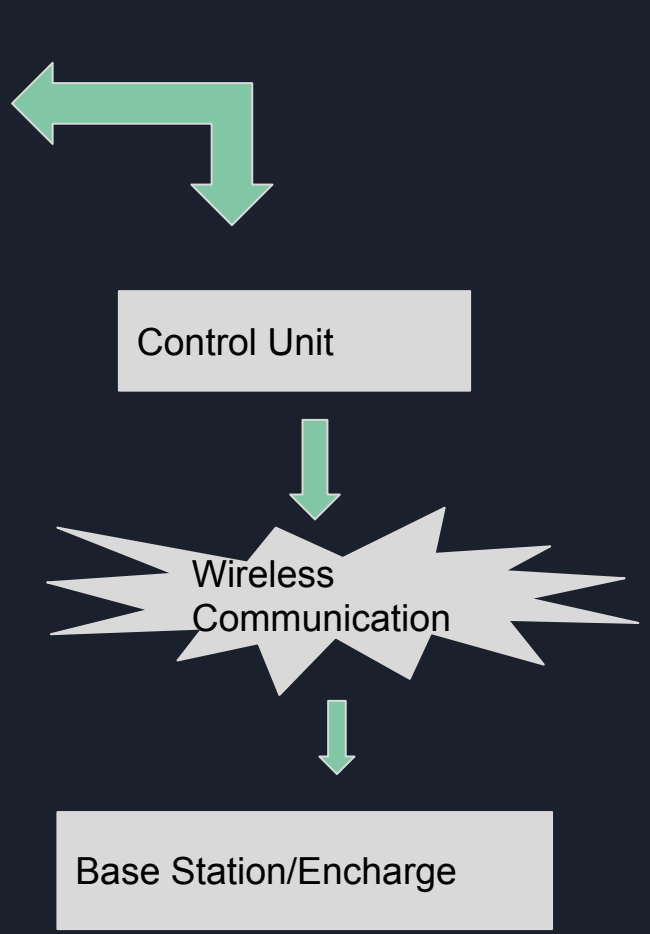
Sensors and Proposed System -:

The core objective of this project is the design and implementation of a smart health tracking system. The sensors are embedded in worker body to sense the temperature and heartbeat of the patient.These sensors are connected to a control unit which calculate the value. These calculated values are then transmitted through a IoT cloud to the base station.

The temperature sensor connected to the analog pin of the arduino controller is converted into digital value with the help of ADC [10]. Using this digital data, the controller converts it into the actual temperature value in degree Celsius using the equation: temperature (°C) = [raw ADC value*5/4095- (400/1000)]*(19.5/1000) .

The heartbeat sensor is based on the principle of photoplethysmography. It measures the change in volume of blood through any organ of the body which causes a change in the light intensity through that organ

Conclusion -:
The system monitored body temperature, pulse rate using sensors, which are also displayed on a LCD. These sensor values are then sent to a medical server using wireless communication. These data are then received in an authorized personals smart phone with IoT platform. With the values received the doctor then diagnose the disease and the state of health of the worker.



AIR PURITY

Air pollution index (API), calculated on the basis of suspended particulate matter (SPM), SO_2 and NO_2 concentrations was highest near the coal mining area.

The ambient concentrations of heavy metals (in PM_{10}) also showed significant temporal and spatial variations at different sites around coal mining areas.The mean concentrations of heavy metals in PM_{10} were found in the order of Fe>Cu>Zn>Mn>Pb>Cr>Cd>Ni.

The major sources contributing to air pollution in are coal mining related activities and active mine fires, and secondarily vehicular emissions, while wind–blown dust through unpaved roads also contributed to some extent.

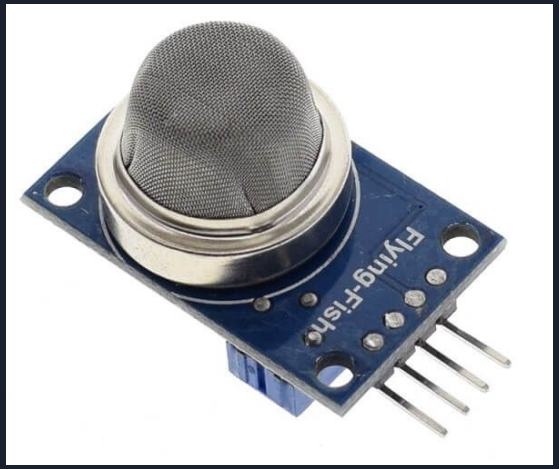
$$API = \frac{1}{3}\left[\frac{SPM}{S_{SPM}} + \frac{SO_2}{S_{SO_2}} + \frac{NO_2}{S_{NO_2}}\right] \times 100$$

SENSORS AND PROPOSED SYSTEM

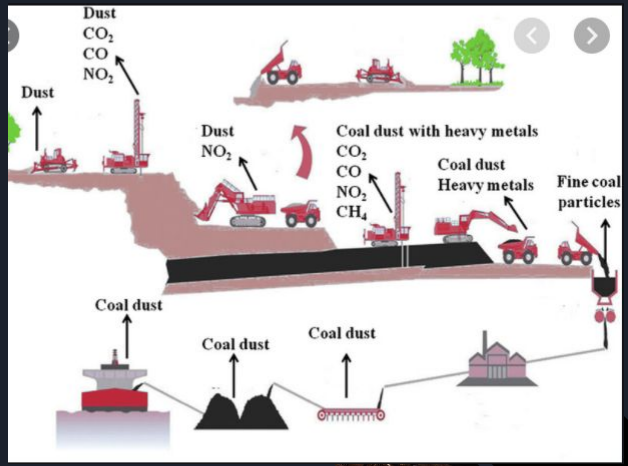
THE MAJOR IMPURITIES THAT WE HAVE ARE SO2, NO2 AND HEAVY METALS, SO THE SENSORS MUST ALARM US WHEN THE CONC GOES BEYOND THE ALLOWED LEVEL.

SO2:

Exposure of more than 5 ppm of SO2 can cause airway resistance in healthy individuals. When particulate matter or other trace components are also present, this level is reduced.In 1971, the USA EPA set the level of SO2 that could cause significant harm to the health of persons at 2620 µg m-3 (1 ppm) (24-hour average). Therefore, the limit must be 1 ppm on a daily basis.



MQ135 AIR QUALITY SENSOR



NO2:

Nitrogen Dioxide (NO2) is a colorless, odorless gas that is commonly emitted from home heating elements such as gas, wood, coal burning appliances. According to the Occupational Safety and Health Administration (OSHA)2, the permissible exposure limit for NO2 in mines should not exceed 5 ppm (9 mg/m3). However, NO2 levels as low as 0.1 ppm have been shown to cause respiratory discomfort in vulnerable populations such as asthmatics.. So, the sensor must alarm us when the concentration reached 5 ppm and if the miner is an asthmatic, he must not be exposed to more than 0.1 ppm.

HEAVY METALS CONCENTRATION MEASURED BY PM10:

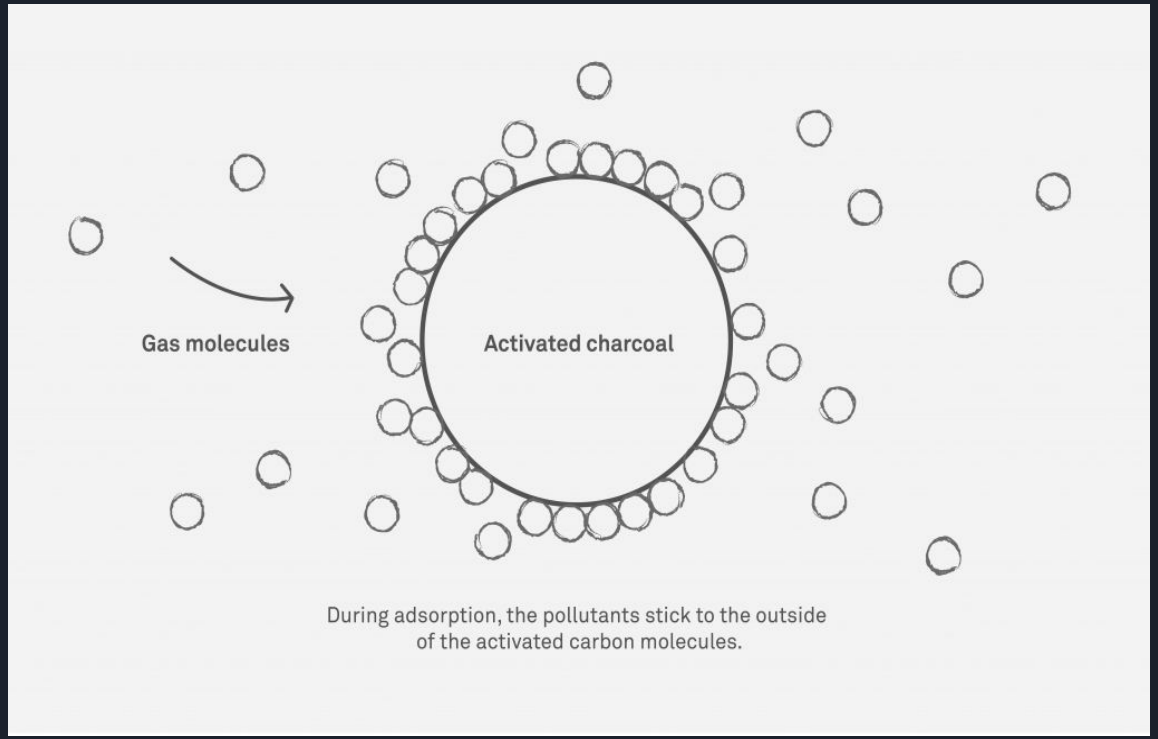
The 24 hr mean concentrations of PM10 ranged between 69.3 to 118.9 microg m(-3), which is well within the permissible limit (150 microg m(-3)) of national ambient air quality standards (NAAQS). The ambient air was mostly dominated by the Fe and least by the Cd, Ni among the metals analysed. So, the sensor must alarm us for a concentration of 118.9 micro g m(-3)

Charcoal Filter

Using the concept of **Adsorption** by charcoal.

- Traps particles less than 0.3 micrometers in size

  These include smoke , oil fumes , VOCs (Volatile Organic Matter) , etc.



Design

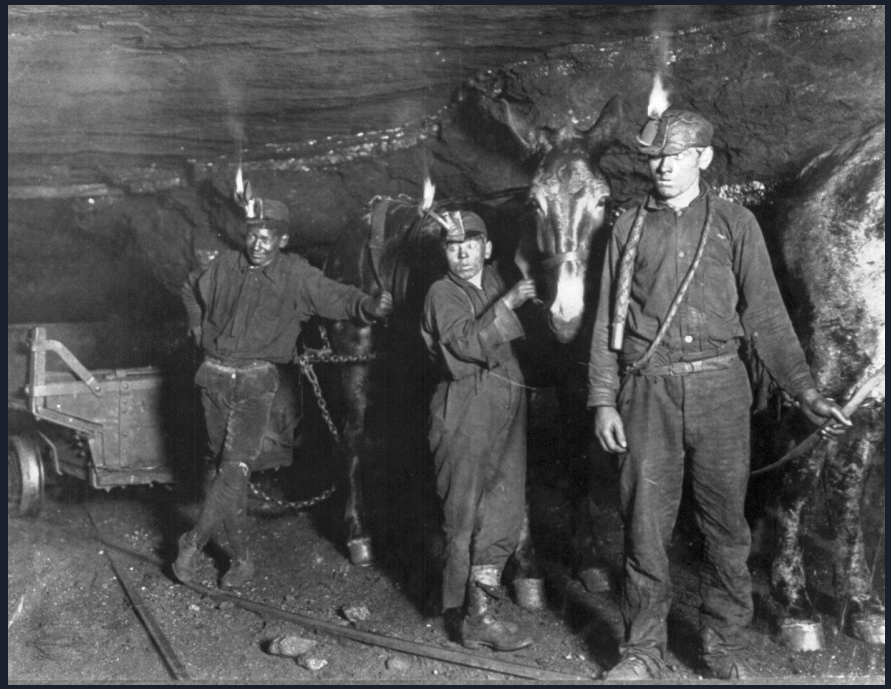
- Design to be chosen such that it fits in the hat , or can be used with it.
- Additionally , an eye gear will be used , for the protection of eyes.
- Instead of the conventionally used filters which has the face shield and filter in a single piece. So , that the movement of the head doesn’t restrict.

Mechanism

- Concept of Adsorption is used.
- As the surface area of the carbon is large , so this can act as a good adsorbent.
- The design is made such that it has a layer of activated charcoal , through which the inhaled air will pass and the suspended particles in the air will get adsorbed on the charcoal before actual inhalation.

Mine height detection sensor

- Sometimes miners have to work in very congested and low heighted mines.
- Due to lack of proper illumination inside the mines, miners may sometimes misjudge the height of the mine and may end up in accidents which lead to injuries.
- To solve this problem we have designed an ultrasonic distance alarm which rings out a tone of 330 Hz when the distance between the helmet and the mine's ceiling is very less.

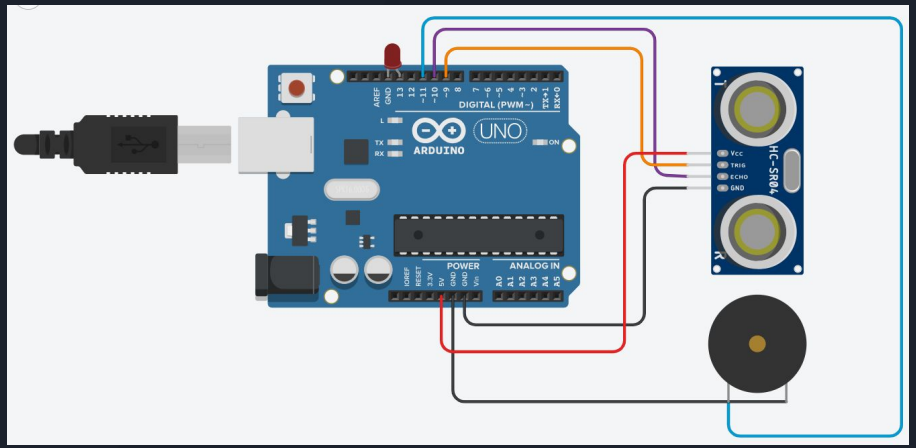


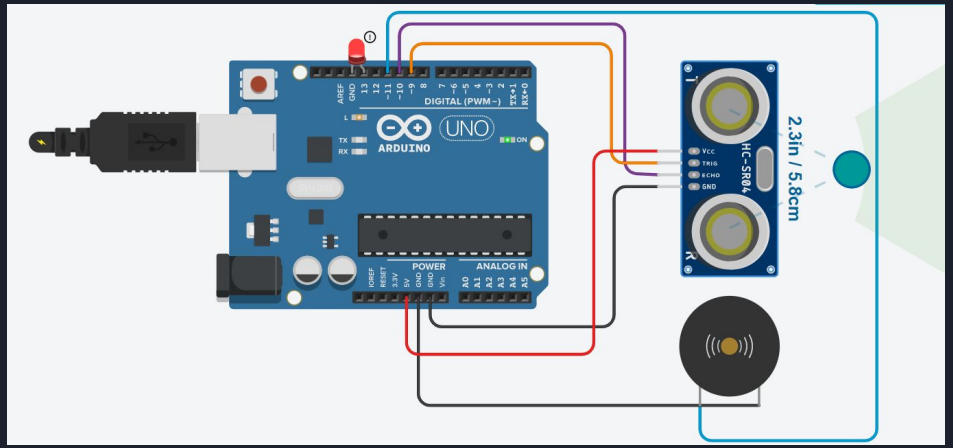
Materials required for making of height detection sensor

Different components required are as follows:

- Ultrasonic Sensor (HC-SR04)
- Piezo buzzer(alarm)
- Arduino UNO R3
- Wires

Circuit connections of the height detection sensor





AMBIENT LIGHTING

Lighting is vitally necessary underground, and it is very important to ensure that there are no failures and the lamp used is efficient as possible

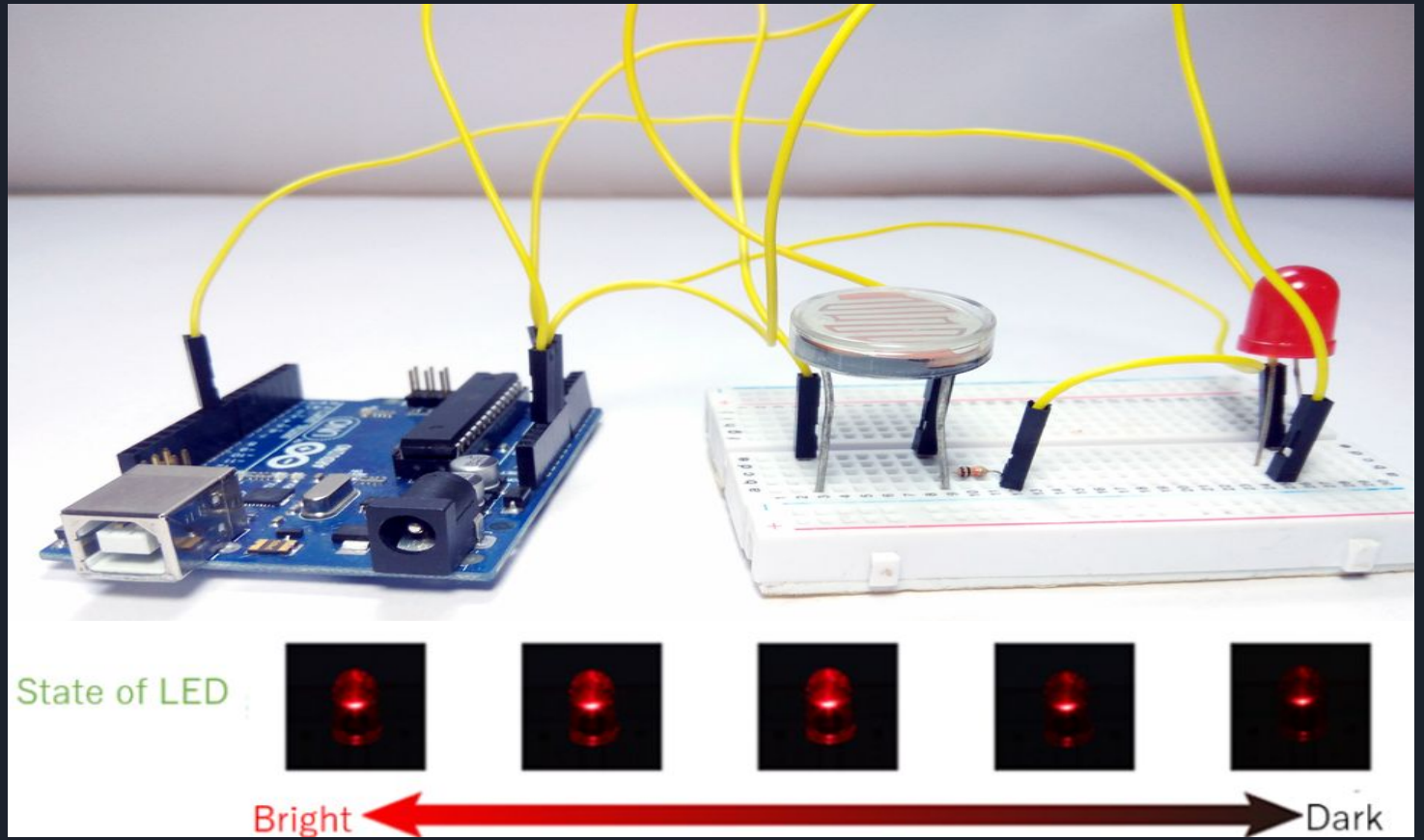
STRUCTURE AND REQUIREMENTS

For this we will need:

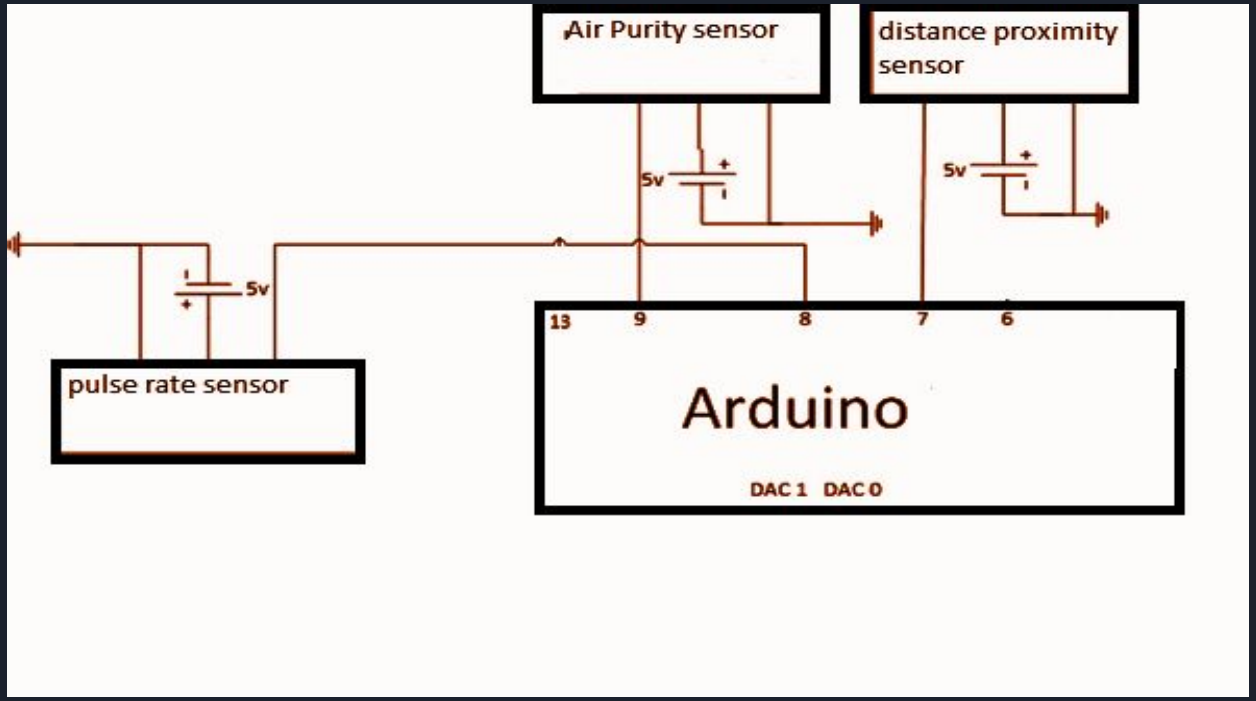
- An LDR (a.k.a. Photo-resistor).
- Arduino UNO.
- 10K Resistor

the LED will be off in complete brightness, and as the brightness in the surrounding decreases, the LED begins to glow brighter.

A SIMILAR CIRCUIT SHOWN



INTERNAL CIRCUIT



MODEL DESIGN

The helmet comprising of the above components will be designed in the following manner:

For the safety in the mines, the exteriors will be insulated with light weighted carbon fibre frame, and covered outlets of only the sensors required to extract information from the surroundings

The interiors will be made of a metal frame which is usually built in mining helmets for protection. The frame will also work as a base of the digital logic circuits and a hub for information.

Comparative Analysis

EXTERIORS:-

The exterior will be fully insulated. A height sensor right at peak of helmet, illuminating LEDs at the front forehead, a pulse monitor on the neck and a charcoal filter covering the front. For proper air inlets, sides will be equipped with slits with same filters to avoid suffocation and good ventilation

INTERIORS:-

The interiors will be the central hub of circuits. A wired framework passing through the main skeleton of the helmet. As per the circuit design. The wiring and main circuit board will be confined to the backside of the helmet. It will also be skimmed with low weighted insulation using carbon fibres.

Thank you!