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SMART HELMET FOR COAL MINE WORKER'S SAFETY

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ABSTRACT

Air Quality becomes an important factor in mining areas where the health condition of the workers is prominentlyconsidered. The composition of many toxic gases under the mining area causes many fatalities that keep on increasingday by day. The Total Volatile Organic Compounds (TsVOC) and C02 creating a significant role in the health systemof the workers. The unstable levelsof these TVOC'scause many healthissues like nausea, emesis, fatigue, epitasisand dyspnea. Exceeding the standard levels of these toxic compounds in the air causes many problems like severebreathing trouble and headache. Coal mining is considered much more dangerousthanhard rock mining. Most of thedeathsoccurindevelopingcountriessuchasIndiaandruralpartsofdevelopedcountries.Becauseofthecomplexity of this environment and the wide range of operations performed, it is vital to check the parameters in the backgroundincrease the efficiency and safety of mineworkers. Keeping this in mind we design a helmet for the safety of mineworkers which is able to detect air condition. Our smart helmet consist of wearable microcontroller,temperaturesensor,photosensor,airqualitysensorandalerttheworkerbeforesomethingwentwrong.

Keywords: Air quality, Wearable microcontroller, sensor, health issue, toxic compounds

I. INTRODUCTION

Mining is very important for the economy of any country as it generates various opportunities for manysectors. As a society, we are blessed to appreciate the benefits that this sector manufactures by processingthese materials and products that supply us. Working on the ground presents many different safety and healthrisks. The environment is disagreeable or shaky. The deeper the mines are, the more harmful it might be toconduct tasks. An accident that occurs while mining minerals or metals is known as a mining accident. Eachyear,tensmining,while accidentsalso happeninmining.Due to rockstratathat areplain,typicallyincompetent rock, presence of CH4 gas, and coal powder, Coal mining is considered significantly moredangerous than hard rock mining. Most deaths nowadays occur in underdeveloped nations and rural areas ofwealthy countrieswhensafety precautionsarenotproperly implemented.Asaresult,itiscriticaltomaintaining track of circumstances that might contribute to an accident to protect human safety. This projectintroduces a device used to keep track of the conditions within a coal mine, which might pose a threat tohumanlife.ThesensorsandLDRareemployedformonitoringinthissystem.Thissystemalsoincorporatesa smart helmet with a panic button that each worker may activate individually. All sensors are linked tospecific applications and send an alert signal when it exceeds a particularvalue. The alarm signal is sent tothe buzzer so that the worker can take the necessary action quickly. If coal mine accidents are not adequatelycontrolled, it may result in massive human fatalities. An environment parameter checking system has beenbuilttorecordortractthereadings ofdangerousgasesandriskyworkingconditions. Over the years, it has been observed that coal mine contributes significantly to the country's rapid economicand social development. Scholars from around the world have undertaken substantial research to improve thedegree of safety. Coal mines are an essential source of energy for human growth Development. Miningfailures may be exploitedto increase security inthe industry.Industrial series of failures orflaws aretypically the cause of an accident. There are a number of practical measures available. Initiatives involvingmines, such as the construction of safety lamps, can significantly impact. Law and creating a self-containedcoal mine safety monitoring system are both in the works. India is increasingly powering itself on coal.About three-fourth of India's electricity is coal-based, its dependence on coal is growing faster than any othercountry in the world (6% a year) and coal extraction has

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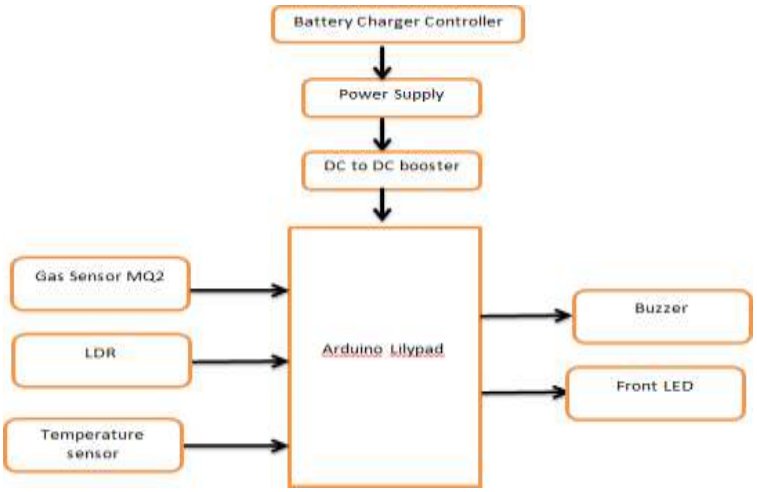
doubled to 500 million tons since 1994. It's killingpeople.The coal complex in India has significant health impacts — mainly through local air pollution —including premature mortality, ranging from 80,000 to 115,000 premature deaths per year," says the study,published in 'Ecological Economics' by Elsevier.Besides, mining accidents have also been taking thousandsof lives: "From 2001 to 2014, more than 7,000 accidents were reportedacrossal oalminingcompaniesinIndia.Inthe threeyearsbetween2015and2017,morethan200coalminers losttheirlivesinsuchaccidents." Underground mines are normally tremendous mazes, of which the passages are typically long andlimited withsome kilometers long and some meters in width. A great many mining employees are had toworkbelow outrageous situations as indicatedby the development necessities,andseveraldiggers minerspass onfromminingmishapsconsistently.

II. METHODOLOGY

Miners deal every day with dangerous gases and high temperature levels in a dark environment. Withthe help of Arduino we designed and developed a Smart Working Helmet that can save their lives, ifsomething goes wrong. The Arduino lilypad is used to detect and monitor variables in a coal mine. Livereadings are provided by the temperature sensor, humidity sensor, LDR, and gas sensor. The lilypad isconnected to all of these sensors. The data is sent to the arduinolilypad. In an abnormal situation, analert signal is given to leds and buzzer. A buzzer is also controlled with the help of Arduino, whichactivates at any abnormal reading detected by the above sensors. A smart helmet is also computed withalilypadwhichsimplyhasapushbuttonconnectedtoit.ANabnormalsituationincludestheconcentration of gases in the air such as LPG, propane, methane, hydrogen, alcohol, smoke and carbonmonoxide. If these harmful gases are present in the air, the led will turn light orange indicating thepresence of harmful gasses which may affect worker's health. Also if he ignores the indication and theconcentration of such gases increases, the buzzer will give an alert and that light orange indication ofLED will turn Dark red. Also we have usedtransistor as a switch to drive the led and buzzer. Thiscircuit works on 3.7v lithium rechargeable battery. To recharge this battery a charger controller is alsoconnected, which can easily recharge the battery.A DC to DC booster is used to boost this 3.7V, so thatall the sensors, leds or buzzer could be driven properly. This measure has been taken to maximize thesafetyof workersincoalfield.

III. WORKING

a) Blockdiagram:



b) Working: The Arduino Smart Helmet is using the Arduino Lilypad board to read values from gas sensor,temperaturesensorandlightsensor. Ithasthreemainabilities:

- If the worker is approaching to a dangerous gas, the helmet will inform him with a warning soundfrom the buzzer. If the environment is too noisy, he will know that he is in danger by the redblinking led in the front of the helmet. The warning sound and the red led will repeated faster as heisapproachingclosertoadangerousenvironment.

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- If the environment temperature becomes higher than the worker's body can withstand (e.g. 45 ºC),the helmet will inform him with a (different) warning sound from the buzzer. If the environment istoonoisy, hewillknowthatheis indangerfromtheredblinking ledinthefrontof thehelmet.
- If the working environment becomes darker, the helmet's front light will be turned on.It has arechargeablebatteryandcanbeeasilyre-programmedtoadjustvaluesoftheworkingenvironment.

IV. RESULTSANDDISCUSSION

ThetemperaturewassuccessfullymeasuredusingDHT-11sensorsduringthetestingphase,andtheoutput was satisfactory. The DTH11 sensor was also used to monitor humidity accurately. The MQ2 gassensor detectedgas concentrations in the areaand successfully generated awarningmessage on theledandthenonabuzzer. Thepicturedesignedprototypeisshowninfig.

Figure1 Topview

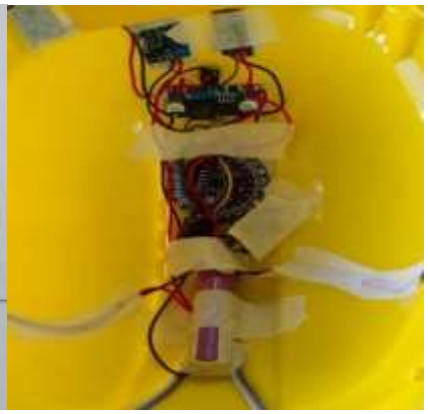

Figure2 Insideview

Figure3 Readingsfromthetemperaturesensor

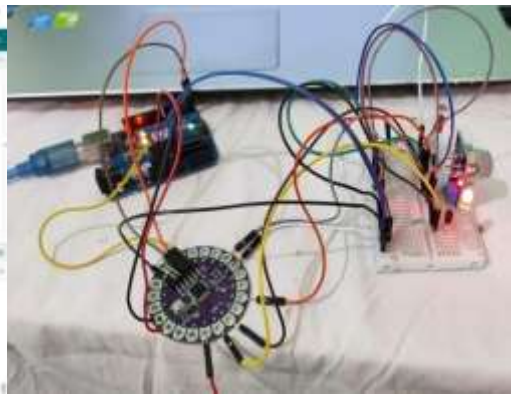

Figure 4 Circuit at the time of testing is illustratedThefinallookof thedesignedprototypeisshownas:

Figure5 BottomView

Figure6 Insideview

V. CONCLUSION

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A clever mining helmet has been designed that can detect three potentially approaches: toxic gas levels, highertemperatureanddarkerenvironment.It'salsopossibletomeasuregasconcentrations.Whenabnormalreadings are measured, the warning sound and the red led will repeated faster as he is approaching closer to adangerous environment. This will aware the worker about the environment conditions such as air quality ortemperature drop or rise as discussed. The safety is the top priority of all in mining industry by using oursystem we can achieve the safety of the mine workers by alerting them before any harmful conditions. Thisproject covered the first aspect of safety of the workers in the underground coal mining. This project is not onlyforcoalminers, butalsowherevertheundergroundworksaredonebytheworkers.

VI. REFERENCES

[1] XushengZandYunlongZ.2010.Accidentcauseanalysisandcountermeasureofcoalandgasoutburstnearlytwoyearsof ourcountry[J]. MiningSafetyandEnvironmentalProtection. 37(1):84-87.

[2] C.j.Behr,A.KumarandG.P.Hancke,„ASmartHelmetforAirQualityandHazardousEventDetectionfortheIndustry", IEEE, PP. 2028-2031, 2016.

[3] MohdKhairul,AfiqMohdRasli,SmartHelmetwithsensorsforaccidentprevention,ICEESE,2013.

[4] https://docs.arduino.cc/retired/getting-started-guides/ArduinoLilyPad

[5] https://docs.arduino.cc/retired/boards/lilypadarduinosimple?queryID=0afb071d0efa186cfeb38cc9fe2fdb cd