M.KUMARASAMY
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DETECTION OF MINING AND MINERAL MATERIALS USING ESP32CAM

A MINOR PROJECT-IREPORT

Submitted by

RESHMA.N	927622BEC165
PRIYADHARSHINI.P	927622BEC156
PRABHAVATHI .K.S	927622BEC145
SAMUTHRA.M	927622BEC170

BACHELOR OF ENGINEERING

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BONAFIDE CERTIFICATE

Certified that this **18ECP103-Minor Project I report "DETECTION OF MINING AND MINERAL MATERIALS USING ESP32CAM"** is the bonafide work of**"RESHMA.N(927622BEC165),PRABHAVATHI.K.S(927622BEC145), PRIYADHARSHINI.P(927622BEC156),SAMUTHRA.M(927622BEC170)**who carried out the project work under my supervision in the academic year **(2023-2024)ODD SEMESTER.**

SIGNATURE
Dr.A.KAVITHA B.E., M.E., Ph.D.,
HEAD OF THE DEPARTMENT,
Professor,
Department of Electronics and Communication Engineering,
M.Kumarasamy College of Engineering,
Thalavapalayam,
Karur-639113.

SIGNATURE
Dr S.MEIVEL,
SUPERVISOR,
Assistant Professor,
Department of Electronics and Communication Engineering,
M.Kumarasamy College of Engineering
Thalavapalayam,.
Karur-639113

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PROJECT COORDINATOR

INSTITUTION VISION AND MISSION

Vision

To emerge as a leader among the top institutions in the field of technical education.

Mission

M1: Produce smart technocrats with empirical knowledge who can surmount the global challenges.

M2: Create a diverse, fully -engaged, learner -centric campus environment to provide quality education to the students.

M3: Maintain mutually beneficial partnerships with our alumni, industry and professional associations

DEPARTMENT VISION, MISSION, PEO, PO AND PSO

Vision

To empower the Electronics and Communication Engineering students with emerging technologies, professionalism, innovative research and social responsibility.

Mission

M1: Attain the academic excellence through innovative teaching learning process, research areas & laboratories and Consultancy projects.

M2: Inculcate the students in problem solving and lifelong learning ability.

M3: Provide entrepreneurial skills and leadership qualities.

M4: Render the technical knowledge and skills of faculty members.

Program Educational Objectives

PEO1: **Core Competence:** Graduates will have a successful career in academia or industry associated with Electronics and Communication Engineering

PEO2: **Professionalism:** Graduates will provide feasible solutions for the challenging problems through comprehensive research and innovation in the allied areas of Electronics and Communication Engineering.

PEO3: **Lifelong Learning:** Graduates will contribute to the social needs through lifelong learning, practicing professional ethics and leadership quality

Program Outcomes

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO1: Applying knowledge in various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of Engineering application.

PSO2: Able to solve complex problems in Electronics and Communication Engineering with analytical and managerial skills either independently or in team using latest hardware and software tools to fulfil the industrial expectations.

Abstract	**Matching with POs,PSOs**
Esp 32 cam,Sensor	**PO1, PO2, PO3, PO4, PO5, PO6,PO7, PO8,PO9, PO10, PO11, PO12, PSO1, PSO2**

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ABSTRACT

This is our new innovative idea to detect minerals and hazards in the soil and we are going to simplify this task using sensor and to Capture the exact settlement of minerals ,we are going to use ESP32-CAM and thus it is possible to take off the minerals from the soil in a very easy way with this innovation.With the help of this new, creative idea, we can identify minerals and potential hazards in the soil.Here, we have a creative idea that makes use of the esp32cam.We are able to see these days miners are facing so many troubles while mining.A new innovative idea aims to detect minerals and hazards in soil using a sensor and ESP32-CAM. This allows for easy removal of minerals from the soil. Miners are facing numerous challenges in mining, and safety is crucial for their safety. The use of a sensor and ESP32-CAM will simplify the task and record the precise location of minerals. This innovative solution will ensure the safe extraction of valuable mineral materials from the earth. The goal is to ensure the safety of miners while ensuring the efficient removal of minerals from the soil.We need to ensure the safety of the miners too and then only we are sure about having in search of valuable mineral materials from our mother earth. We plan to use a sensor to make this task easier, and an ESP32-CAM to record the precise location of the minerals. With this invention, it will be possible to remove minerals from the soil quickly and easily.

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LIST OF ABBREVIATIONS

ACRONYM	ABBREVIATION
IOT	Internet of Things
ESP32CAM	Espressif Systems 32 Camera
FTDI	Future Technology Devices International Limited
MI	Mining Industry

CHAPTER 1

INTRODUCTION

Mining is an important economic activity in India. India is one of the largest exporters of iron ore, chromite, bauxite, mica and manganese, and it is ranked fifth among the mineral-producing countries in terms of volume of production.so many technologies are bloomed enoughtough we don't much safety ensuring facilities for miners.The main toxic gases in mines are carbon monoxide (CO) and carbon dioxide (CO2); the flammable gases are methane (CH4), CO, and hydrogen (H2); the suffocating gases are CO2, nitrogen (N20), and CH4; and the toxic gases are CO, nitrogen oxides (NOx), and hydrogen sulfide (H2S).White damp, or carbon monoxide (CO), is a particularly toxic gas; as little as 0.1 percent can cause death within a few minutes.we do mining for various purpose and the major aim is detection of minerals and here we are with ESP 32CAM which can detect various mineral materials and also we are to use safety ensuring sensors to detect the upcoming hazards during mining and with the help of some blooming softwares we are here to provide a solution for the miners.

Problem statement:

Most of miners suffer from various respiratory and skin diseases such as asbestosis, silicosis, or black lung disease. Furthermore, one of the biggest subset of mining that impacts humans is the pollutants that end up in the water, which results in poor water quality and sometimes they are tend to be lost their life.To detect the mineral materials and hazards faced by the miners during mining, it's essential to use software and optical system to provide them a better world.

OBJECTIVES:

Clearing Intimating that our system is used in predicting the hazards and ensuring the safety of the miners and providing a better view for detecting the minerals.

CHAPTER 2

LITERATURE SURVEY

By leveraging the power of the model, we seamlessly integrated the ESP32-CAM and buzzer to craft an innovative IoT system. The ESP32-CAM acted as the central hub, efficiently capturing and transmitting real-time video and image data to our network. This allows us to monitor and control devices remotely, enhancing the system's versatility. The buzzer played a vital role in providing audio feedback and alerts, enabling timely notifications for critical events.The purpose of this paper is to present a review of environmental[1] impacts of the mining (also referred to as extractive) industry. The paper has reviewed 55 articles and documents to reveal environmental impacts associated with the industry.The main impacts uncovered are:

The lack of documented environmental impacts for several operational mines is a crucial issuehighlighted in the review. Though it is a legal requirement in many countries to report baselineenvironmental data, thereview reveals thatthis requirement ishardly adhered to byminingcompanies across the globe. For other operations such as off-shore mining, there is a vacuum ofimpactresearch. Inadequate miningmonitoringistobe blamedfor lackof dataand documentation.

The main conclusions from the review are as follows. First, there is a need for more research toassess environmental impacts attributable toMI. Impacts on off-shore mining operations arerecognized as a subject that needs further research in particular. Second, the paper highlightsthat the environmental impacts, apart from the discovery of new archaeological artefacts, are alladverseon the environment. This important finding urges the critical necessity toinvestigateadverseon the environment. This important finding urges the critical necessity toinvestigate

remedial measures as a matter of very high priority in order to alleviate environmental impacts.Third, many operational mines do not have a good record of the environmental impacts evenwhen there is evidence that such impacts have already emerged in its operations. The cause isinadequateor the absence of baseline environmental databaseas well as weak monitoring of environmental changes and documentation.These three key-areas should deserve a greater attention in future operations.Finally,the paper calls for an in-depth investigation for a comparison of net returns to mining activity .The net returns should carefully consider all ofenvironmental costs,socio-economic costs and benefits. The analysis of net returns will alsoserve to determine the level of investment that should go back into the community in mining areas.It defines mining industry (MI) which is also known as the extractive industry as aprocess of extraction of valuable minerals or other geological materials from the earth, usuallyfrom an orebody, lode, vein, reef or placer deposit. These deposits form a mineralized package that is of economic interest to the miner. Thisdefinition suggeststhatthe MI consistsofoperations that remove metals, mineral, liquid and aggregates from the earth. By nature of the industry,the resource is non-renewable. Examples of MI are extractionof oil, gas, metals,industrial minerals, coal, gemstones, rocks, clay, sand, lime, rock phosphate, etc. whilst miningprocess refers to activities such as drilling, dredging, blasting, exploding, chemical extraction,quarrying, etc. The scale of extraction may range from traditional (artisanal mining) to large-scale operations, the latter practiced by multi-national companies.

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CHAPTER 3

EXISTING SYSTEM

ESP32CAM play vital role to detect the mining material.It consist of OV2640 camera and several GPIO pins that are used to connect to the software device. ESP32CAM contain Wi-Fi module Bluetooth and camera module 2MP.It is small camera module that can work independently. ESP32CAM can be operate using Arduino IDE software .ESP32CAM take photo of the mineral material and send the photos to the peripheral device which is connected with ESP32CAM . The ESP32 board has a small antenna connection on the bottom of the module .Using the external antenna we can solve problem related with slow video streaming web servers and other connectivity problem.There are three GND pins and two power pins.The two power pins are 3.3V and 5V.The power pins are used to upload code to the board. The output from the ESP32CAM is recognized by peripheral device and it identify the type of material.

Hardware Components

ESP32-CAM: The ESP32-CAM is a highly versatile and compact development board [32], bringing together an ESP32 microcontroller module, an OV2640 Camera Module with 2MP resolution and a small 802.11b/g/n Wi-Fi BT SoC module. This powerful combination allows for a wide range of applications, including the exciting possibility of face recognition [33] and object detection [34]. With its minimal 40 × 27 mm footprint, the ESP32-CAM can function independently, making it an excellent choice for projects requiring a small and self-contained system. The convenience of its DIP package and features like GPIO pins and a microSD card slot further enhance its utility. Additionally, programming the ESP32-CAM is made easy using the Arduino IDE with the ESP32 core installed.

Buzzer: A buzzer is a fundamental electronic sound-producing device that finds applications in a wide array of scenarios, such as alarms, timers, notifications and electronic games. By being driven by a DC voltage, this small PCB mountable 5V active device generates a simple, continuous and often monotonous sound. It typically consists of two positive and negative pins, allowing for straightforward integration into various circuits and systems.

Future Technology Devices International Limited (FTDI) module:

ESP32-CAM does not have a program chip. To program this board, an FTDI [35] to TTL module was used. This device handles all serial data communication to the board.

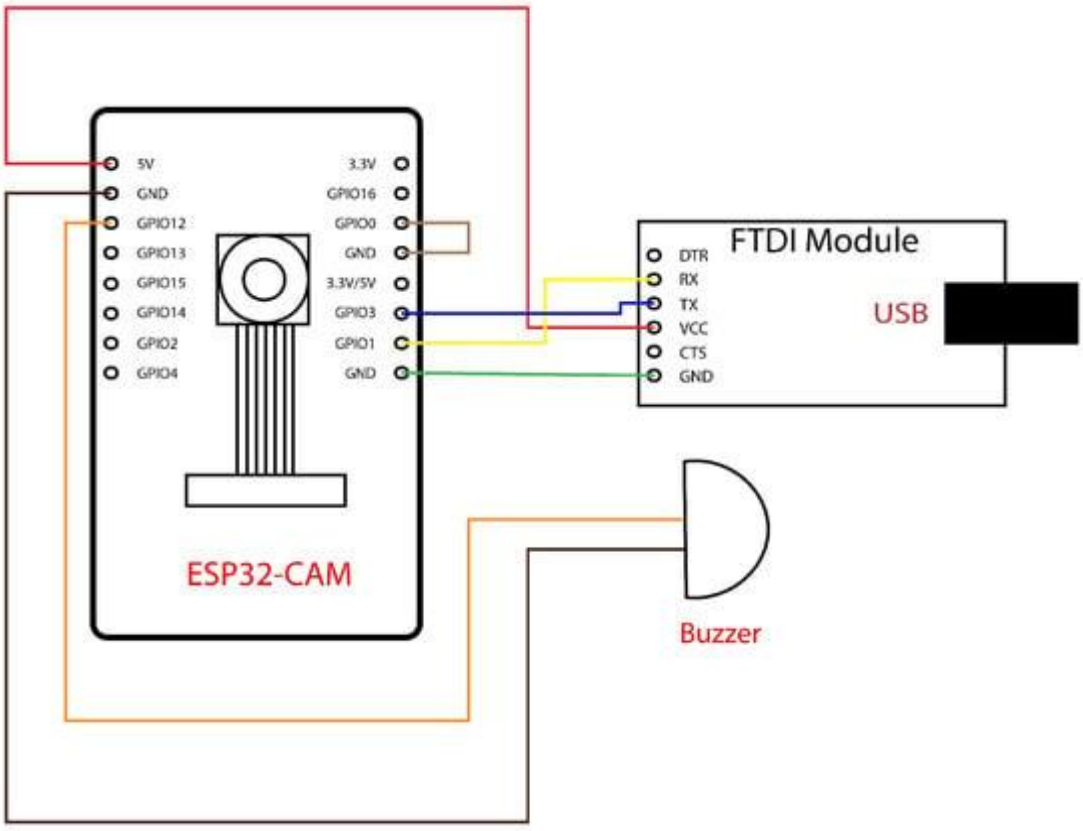

FIGURE 1.1: Hardware diagram of ESP32-CAM and buzzer.

BLOCK DIADRAM

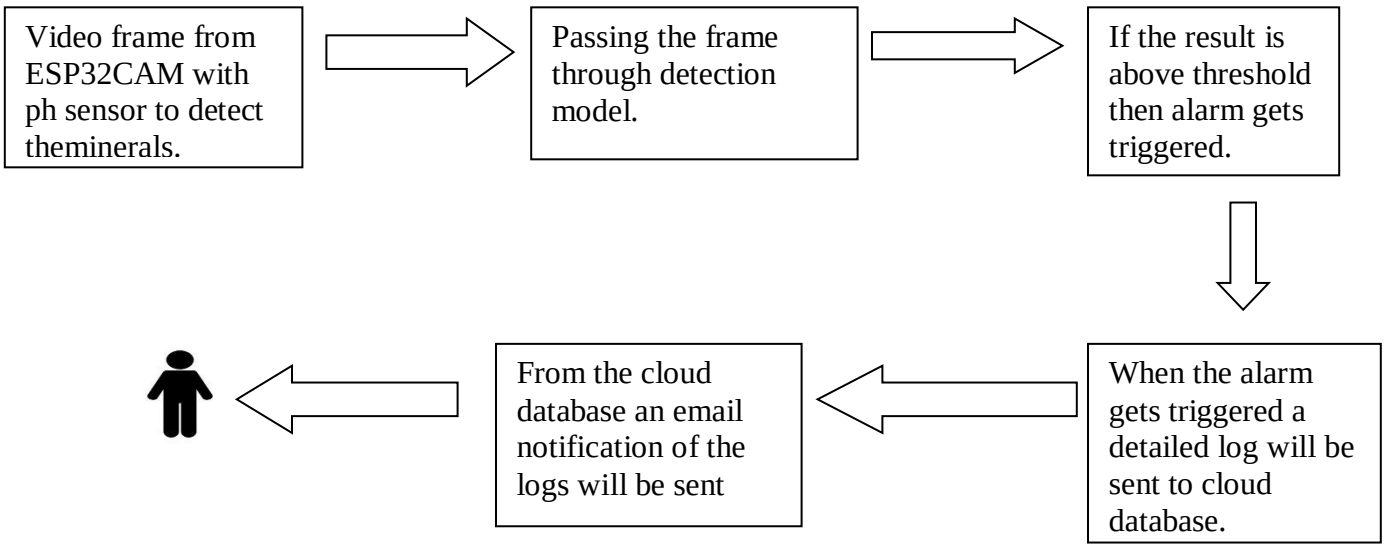

FIGURE1.2: Block diagram of the working of ESP32CAM.

CHAPTER-4

PROPOSED SYSTEM

Modern mining is adopting advanced sensor-based technologies to enhance operational safety and efficiency and optimise mining productivity. Sensors are used in each step of the mining operation, from mine exploration, surveying, and underground mapping, to ore extraction, sorting, and mineral processing. Mine operators also rely on sensors and detection equipment to monitor the condition of mining infrastructure, the environment and equipment, as well as avoid downtimes and operational hazards. Sensor-based technologies are indispensable in remote and automated mining applications.

1) Mining Technology has listed leading suppliers of sensor-based detection and monitoring equipment and solutions for mining applications, based on its experience in the sector.
2) The list includes suppliers of a comprehensive range of sensor and monitoring systems, including gas and smoke detectors, temperature sensor remote monitoring systems, as well as sensors used as part of mineral processing technology to maximise recovery.
3) The information contained within the download is useful for mine operations managers, quality control supervisors, mine health and safety officials, ore processing and metallurgical consultants, mining fleet and plant managers, mineral processing engineers, and individuals involved in mine operations and process enhancement.
4) The download contains detailed information on specialists in sensor-based detection and monitoring solutions for mining and their product and service lines, alongside contact details.

Sensors and monitoring systems for mining applications

Sensor-based detection and monitoring solutions for the mining industry include:

- Sensors to measure and monitor airflow and pressure in mine shafts
- Temperature sensor remote monitoring systems
- Gas and smoke detectors
- Level measurement sensors and vibrating wire sensors to monitor underground mine stability
- Magnetic susceptibility meters and spectrometers for detecting wear and tear in mining machinery
- Sensor-based technologies to detect and analyse minerals in the exploration field
- Sensor-based ore sorting equipment and technologies
- Radar sensor for bulk solids processing
- Sensors to detect and measure mineral concentrations in different stages of ore processing
- Real-time mine monitoring software solution.

CHAPTER-5

SOFTWARE USED

Arduino IDE

The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino boards. The IDE application is suitable for different operating systems such as **Windows, Mac OS X, and Linux**. It supports the programming languages C and C++. Here, IDE stands for **Integrated Development Environment**.

The program or code written in the Arduino IDE is often called as sketching. We need to connect the Genuino and Arduino board with the IDE to upload the sketch written in the Arduino IDE software. The sketch is saved with the extension '.ino.'

WOWKI SOFTWARE :

Wokwi is an online Electronics simulator. You can use it to simulate Arduino, ESP32, STM32, and many other popular boards, parts and sensors.

Here are some quick examples of things you can make with Wokwi:

- Arduino Uno "Hello World"
- Blink an LED on ESP32
- Monitor the weather on ATtiny85
- Control 32 Servos with Arduino Mega
- Animate an LED Matrix with FastLED
- 7 Segment Counter with MicroPython on ESP32

Wokwi creates tools for the Arduino and maker communities, such as AVR8js, the Open source Arduino Simulator, Arduino Library Examples Playground, and GoodArduinoCode.

PYTHON SOFTWARE :

Python programming language and its associated software ecosystem. Python is a versatile and widely-used programming language known for its simplicity andreadability. Python Language: Python is a high-level, interpreted, and generalpurpose programming language. It was created by Guido van Rossum and firstreleased in 1991. Python emphasizes code readability and a clean, concise syntax,which makes it an excellent choice for both beginners and experienced developers.Python Software Ecosystem: Python's strength lies in its extensive softwareecosystem, which includes a vast collection of libraries, frameworks, and tools.These resources empower developers to build a wide range of applications, fromweb development and data analysis to machine learning and scientific computing.Python Standard Library: Python comes with a comprehensive standard library thatcovers various areas, including file handling, networking, regular expressions, andmore. This library simplifies many common programming tasks and reduces theneed for external dependencies.

CHAPTER-6

SOURCE CODE

```
#include <Adafruit_MPU6050.h>
#include <Adafruit_Sensor.h>
#include <Wire.h>
#include <Adafruit_SSD1306.h>

#define OLED_RESET 4 // Define OLED reset pin
#define buzzerPin 13 // Buzzer pin

Adafruit_MPU6050 mpu;
Adafruit_SSD1306 display(OLED_RESET);
const int threshold = 10.0; // Define the acceleration threshold for earthquake
detection

float previousX = 0.0; // Store previous X-axis acceleration value

void setup() {
  Serial.begin(115200);

  while (!mpu.begin()) {
    Serial.println("MPU6050 not connected!");
    delay(1000);
  }
  Serial.println("MPU6050 ready!");

  pinMode(buzzerPin, OUTPUT); // Set buzzer pin as output

  // Begin OLED display
  display.begin(SSD1306_SWITCHCAPVCC, 0x3C); // Use I2C address 0x3C for 128x64
  OLED
  display.display(); // Clear the display
  display.setTextSize(1); // Set text size
  display.setTextColor(WHITE); // Set text color to white
  }

  void loop() {
  sensors_event_t event;
  mpu.getAccelerometerSensor()->getEvent(&event);

  float currentX = event.acceleration.x; // Get current X-axis acceleration value

  // Detect sudden changes in X-axis acceleration
  if (abs(currentX - previousX) > threshold) {
    // Display earthquake message on OLED
```

```
display.clearDisplay();
display.setCursor(0, 0);
display.println("Earthquake detected!");
display.display();

// Sound the buzzer to indicate an earthquake
tone(buzzerPin, 1000);
Serial.println("Earthquake detected!");

// Delay for 5 seconds to prevent the buzzer from sounding continuously
delay(5000);

// Stop the buzzer
noTone(buzzerPin);

// Delay for 5 seconds before clearing the OLED display
delay(5000);
display.clearDisplay(); // Clear the earthquake message after 5 seconds
}

previousX = currentX; // Update previous X-axis acceleration value

// Delay for 250 milliseconds for continuous monitoring
delay(250);
}
```

CHAPTER-7
CONCLUSION

The implementation of detection of mining and mineral materials using ESP 32CAM to detect mineral which is a natural substance with distinctive chemical and physical properties, composition, and atomic structure and is not only to showcase the better optical activity, its also to pinpoint the unknown huge betterment view of rare and precious minerals. We can add various sensors to predict the hazards to be faced by miners during mining and to reduce all those things we are using these sensors.In order the check the PH of soil we are using PH sensor and to detect hazardous gas we can use gas sensor and temperature sensor is also used in predictions of weather. Further to ensure the safety of the miners in mining to detect valuable minerals, we are to fix an accelerator in detecting the possibilities of earthquake while mining since its a very basic requirement to ensure the safety of the miners .In Conclusion, our project has laid a foundation in ensuring the safety of the miners and gave a new way in viewing the mineral materials with ESP 32CAM and with the better software technology.

CHAPTER-8

RESULTS AND DISCUSSIONS

The main aim of this project is to avoid the risks and losses invloved while minning the materials.Eventhough in today's modern world with the availability of lot and lots of technology we are still facing problems many problems in mining sector ,but by implementing this idea we can reduce the amount of losses when compared to the other existing methods.This method of mining makes the work a lot easier and safer.The temperature inside the mining field can be determined using temperature sensor,and by using the ph sensor we can also detect the mineral material present in the soil with the help of ESP32CAM.In this way we can avoid the risks and we can also save more time.

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