International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 11 Issue 1 ǁ January 2023 ǁ PP. 93-104

Obtaining Measurements of Mineral Ore Using Image Processing.

Mrs. Swaroopa
Assistant
Deptof CSE

Dr.M.V.Vijaya Saradhi Professor
Professor and Head
DeptofCSE

ABSTRACT
The twenty-first century is bringing radical changes in mineral industry. High speed and low cost computational and sensing devices make it possible to reach at remote location and instantaneous control on the processes. Image processing which was very useful for some selected applications is getting popularity in mineral industry in changed scenario. OpenCV is one of the famously used open-source Python libraries meant exclusively for Computer Vision. Modules and methods available in OpenCV allow users to perform image processing with a few lines of codes.
Identifying Mineral Ores and calculating their cost by huge machines is the general process which we perform usually. This may be a time-consuming process and a difficult task to eperformed. So, to reduce this work and time load we can simply use Image Processing Method where we can use the image of the Mineral Ore and by scanning it we can find the coordinates of the Ore.
Early ways for calculating the cost of the ores can be performed but Image Processing can be an efficient and easy way. The main purpose of this project is to calculate the size, shape of the ore.OpenCV is ***a Python open-source library, which is used for computer vision in Artificial intelligence, Machine Learning, face recognition, etc****.*
OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built ***to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products****.*
OpenCV is a great tool for image processing and performing computer vision tasks. It is an open-source library that can be used to perform tasks like face detection, objection tracking, landmark detection, and much more.
OpenCV is ***a Python library that allows you to perform image processing and computer vision tasks***

Date of Submission: 01-01-2023 Date of acceptance: 08-01-2023

I. INTRODUCTION:

Most metals are too reactive to exist on their own in the ground. Instead, they exist combined with other elements as compounds called ores. Ores are raw materials for making metals.
Ores are usually used to extract metals economically. A large number of ores are present. All ores are minerals.

Ore is the rock from which the metal is extracted in a convenient and economical way. Ore has a composition that is definite. Metals that occur naturally in the earth's crust are called minerals. Minerals that can profitably be used to get the metal are called ores.

Mineral liberations that would be obtained by grinding an ore to a specific size can be predicted by analyzing unbroken ore pieces, and mineral liberations in ground ores and mill products can be determined directly by image analysis. Predictions of mineral liberations are made by measuring size distributions and textures of mineral grains by image analysis and using liberation models. Ground ores and mill products are analyzed to determine the proportion of mineral that is liberated, and the data are used to evaluate mineral behavior during mineral beneficiation.

The liberation data for minerals in a suite of mill products from a circuit are processed by a material balancing technique to calculate recoveries of minerals in different types of particles throughout the circuit. The liberation-materials balance data define mineral recoveries; define the behavior of an ore in a concentrator, pilot plant or bench test; and indicate whether recovery improvements are possible and/or feasible.

The particle size distribution of run-of-mine ore exhibits a great influence on the grinding process. Variations in the particle size distribution directly affect the throughput and power consumption of mills, especially autogenous (AG) and semi-autogenous (SAG) grinding mills. Therefore, it is critical to evaluate the size distribution of run-of-mine ore on the conveyor belts in real time. The measurement of the particle size distribution by sampling and sieving is considered a common and time-consuming method. The analysis method based on machine vision is considered a non-invasive, fast, and inexpensive technique for rock size measurement. Since the 1980s, many studies have been conducted to evaluate the particle size distribution of materials on a conveyor belt based on machine vision and image processing technology

II. LITERATURESURVEY:

Scholars have mainly followed three aspects of exploration.
The first aspect includes accurate ore contour detection algorithms.
The second aspect is the reasonable evaluation model which is used to convert two-dimensional information of ore into three-dimensional information, and then evaluating energy consumption or particle size distribution.
The third aspect is new technology including neural networks, deep learning, and genetic algorithms, etc. In 1988, Lange developed an on-line, real-time system which can capture images of rocks on conveyor belts, and process images to get the chord-length distributions, and then transform chord-length distributions to equivalent sieve sizes. Lange offered a method to distinguish belt ores of different size distribution**s.**
Lin and Miller developed an image-based system which used image processing technology to get the chord-length of rocks, and used two kernel functions to calculate the cumulative chord-length distributions of regularly and irregular shaped particles, respectively. The last step was to transform the chord-length distributions into size distributions by the transformation Equation.

- In 1997, Yen and co-workers used an empirical correction function to solve the coarse particle overlap problem [7]. Before 2000, limited by hardware technology, it was difficult to get sharp images and many algorithms that consumed too much computer performance could not be adopted. The scholars mainly researched the image-based system software and hardware framework, contour detection, reasonable measurement parameters and size transformation functions.
- After 2000, with the rapid development of computer hardware and new technologies, the image-based, online, and real-time particle size measurement development made much progress. Singh and Mohan Rao extracted RGB color information, visual texture of particles, and developed a system based on a radial basis neural network. The system was used for ore classification and ore sorting.

Al-Thyabat and co-workers evaluated ore image segmentation results by means of Feret's diameter and equivalent area diameter, and experimented and discussed the effect of camera positions

- **1.Mineral grains recognition using computer vision and machine learning:**

Computer vision coupled with machine learning can classify mineral of sand grains.
Traditional segmentation and deep learning algorithms failed.
New mathematical features of sand grains are implemented.
A proper new dataset for mineral sand grains recognition is created.
Results of the mineral recognition reach 90% of good classification.

- **2.Ore image classification based on small deep learning model: Evaluation and optimization of model depth, model structure and data size:**

Hence, we systematically evaluate and optimize the training efficiency and classification accuracy of ore image by considering the model depth, model structure, dataset size of six small deep learning models established under the guidance of Alex Net and VGG Net. This paper is of great significance for the selection of small deep learning classification models for oreimages with differentdataset size.

III. SYSTEMANALYSIS:

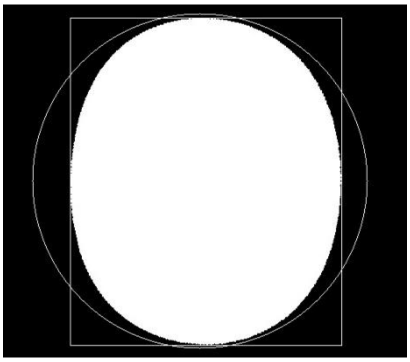
3.1. EXISTINGSYSTEM:

- Identifying Mineral Ores and calculating their thickness, size, shape and structure by huge machines is the general process which we perform usually. This may be a time-consuming process and a difficult task to be performed.
- In the existing system, mineral ores are calculated manually with the help of huge machines.
- This requires lot of time and energy for humans to perform his process.
- Traditionally it has been possible to get semi-quantitative estimates of the grain size by observation using an optical microscope. Ore texture can be imaged relatively easily using modern systems. The problem is to interpret these measurements in a way that can be related to the grain size as it controls the liberation of the particles.
- There are two major difficulties:
- The estimate of the "size" is always biased since, due to sectioning, the image of the grain is always less than or equal to the true "size" of the grain;
- Also, the characteristics of the sections observed depend on both the shape of the grains as well as the distribution of sizes of these grains.
- If all the grains were perfect spheres it would be possible to estimate the size distribution of the grains in the ore.

3.2. PROPOSEDSYSTEM:

The main purpose of the proposed system is to calculate of an ore which can be observed by various parameters. There can be five different parameters used to calculate an Ore.

- Minimum Enclosing Circle.
- Centroid.
- Total Perimeter.
- Total Area.
- Largest Diagonal.
- By using the above parameters we can calculate the shape of an ore , its size for the ore.
- Generally, it can be checked manually with the help of machines which is a lot of time-consuming process, it contains heavy work load, also the results may not be accurate. So as by performing Image Processing, we can solve that issue.



CALCULATING THE ORE BODY:

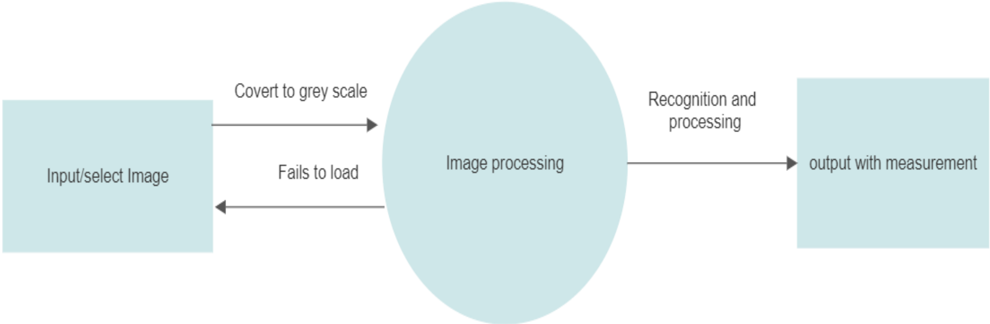
IV. SYSTEMDESIGN:

4.1. DATA FLOW DIAGRAM:

- Data flow Diagram is also known as Context Diagram.
- It's Designed to be an abstraction view, showing the system as a single process with its relationship to external entities.
- It represents the entire system as a single bubble with input and output data indicated by incoming/outgoing arrows.
- It is a graphical or visual representation using a standardized set of symbols and notations to describe a business's operations through data movement.
- Here, we will see mainly 5 levels in the data flow diagram, which are: 0-level DFD, 1-level DFD, 2-level DFD,3-level DFD and,4-level DFD. Itincludes **data inputs and outputs, data stores, and the various sub processes the data moves through**. DFDsarebuiltusingstandardizedsymbolsand notationtodescribevariousentitiesandtheirrelationships.

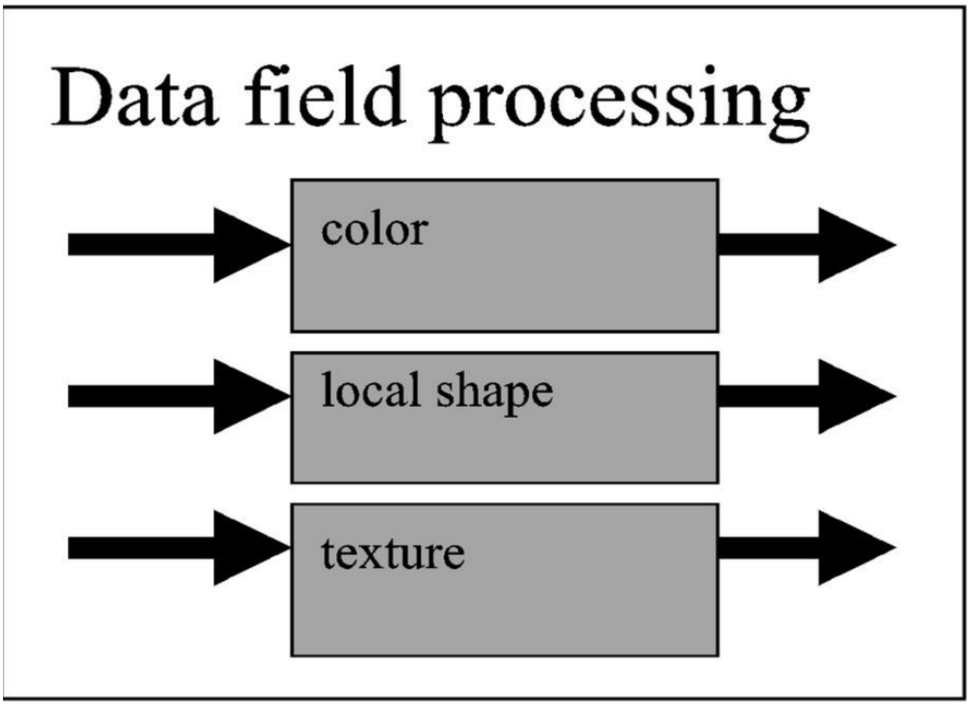
4.1.1 LEVEL-0 DATA FLOW DIAGRAM:

This diagram shows the system body of the proposed design.

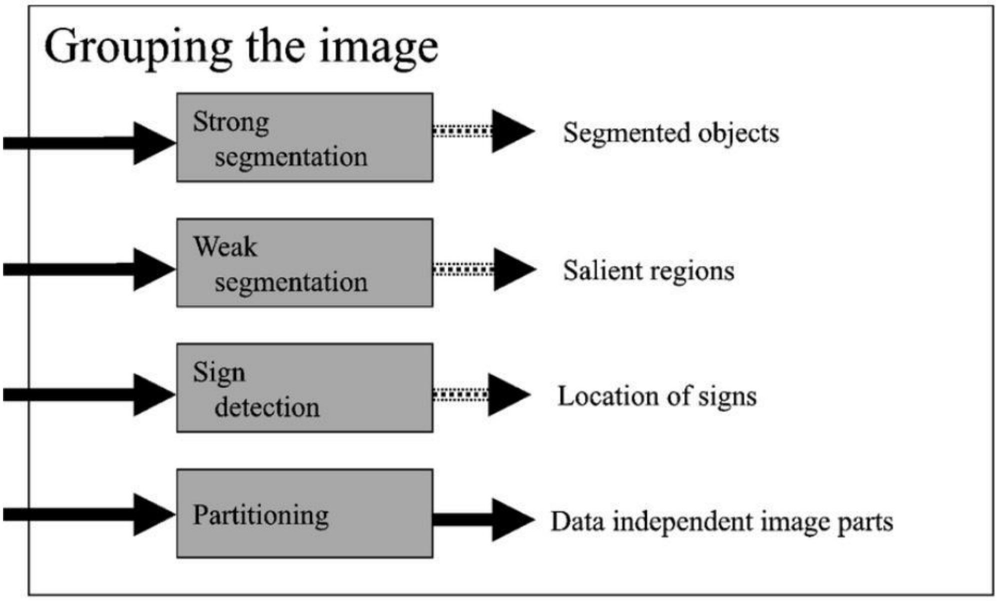


4.1.2. LEVEL-1 DATA FLOW DIAGRAM:

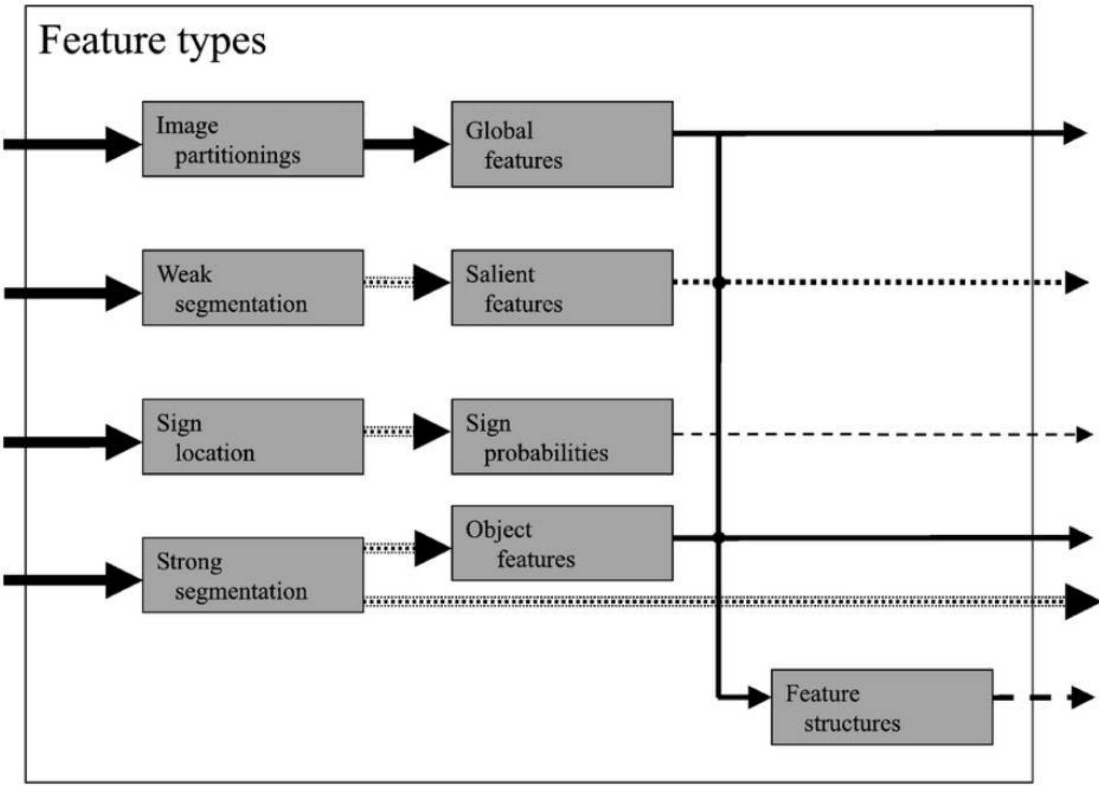
The following diagram shows the level-1 design.



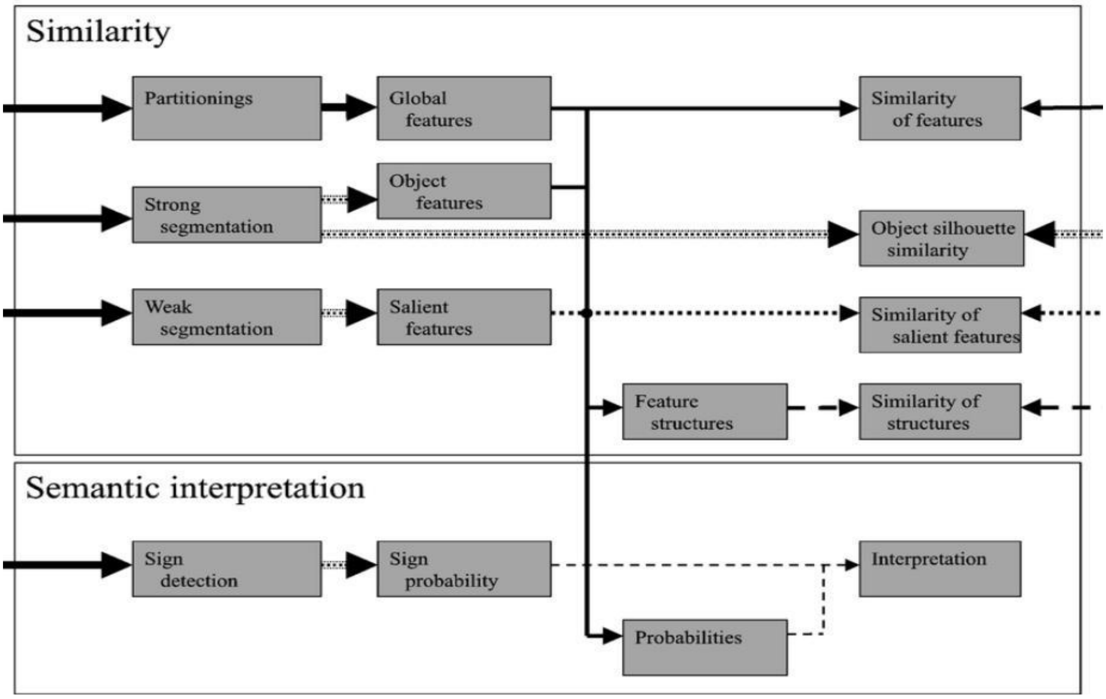
4.1.3. LEVEL-2 DATA FLOW DIAGRAM:



4.1.4.LEVEL-3 DATA FLOW DIAGRAM:



4.1.5. LEVEL-4 DATA FLOW DIAGRAM:



4.2. UMLDiagrams
TheUMLdiagramsarecategorizedinto**structuraldiagrams,behavioraldiagrams,**andinteraction**overview diagrams.**

- A UML diagram is a diagram based on the UML (Unified Modeling Language) with the purpose of visually representing a system along with its main actors, roles, actions, artifacts or classes, in order to better understand, alter, maintain, or document information about the system**.**

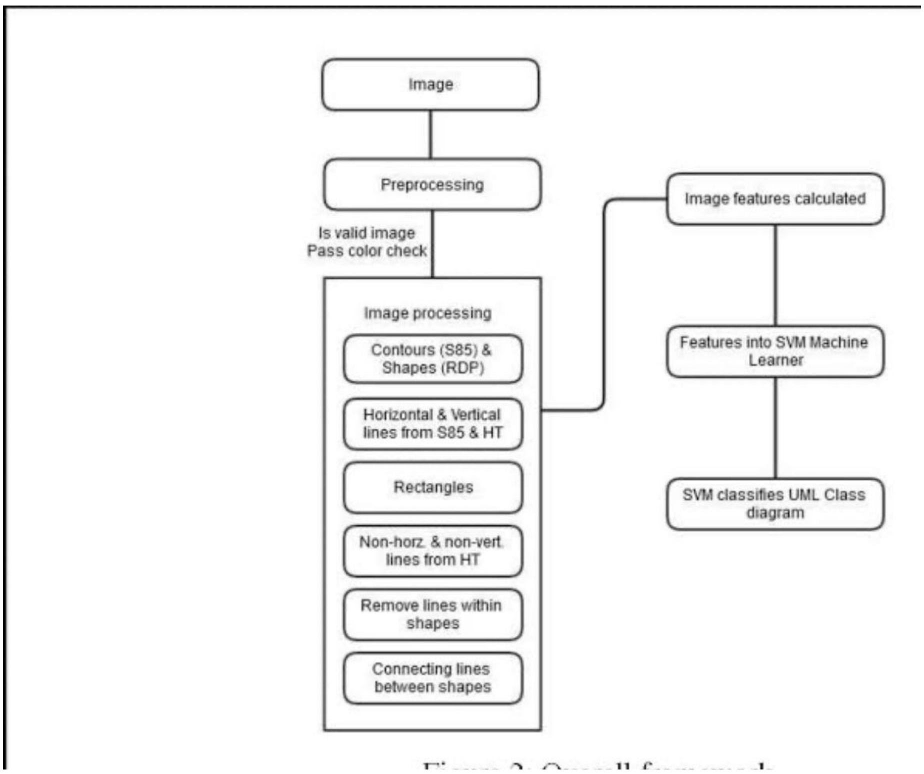


Fig. UMLDiagram

We prepare UML diagrams to understand the system in a better and simple way. A single diagram is not enoughto cover all the aspects of the system.
UML defines various kinds of diagrams to cover most of the aspects of asystem.

4.2.1. FLOWCHART:
A flowchart is a diagram that depicts a process, system or computer algorithm. They are widely used in multiple fields to document, study, plan, improve and communicate often complex processes in clear, easy-to-understand diagrams.

Flowcharts, sometimes spelled as flow charts, use rectangles, ovals, diamonds and potentially numerous other shapes to define the type of step, along with connecting arrows to define flow and sequence. They can range from simple, hand-drawn charts to comprehensive computer-drawn diagrams depicting multiple steps and routes.

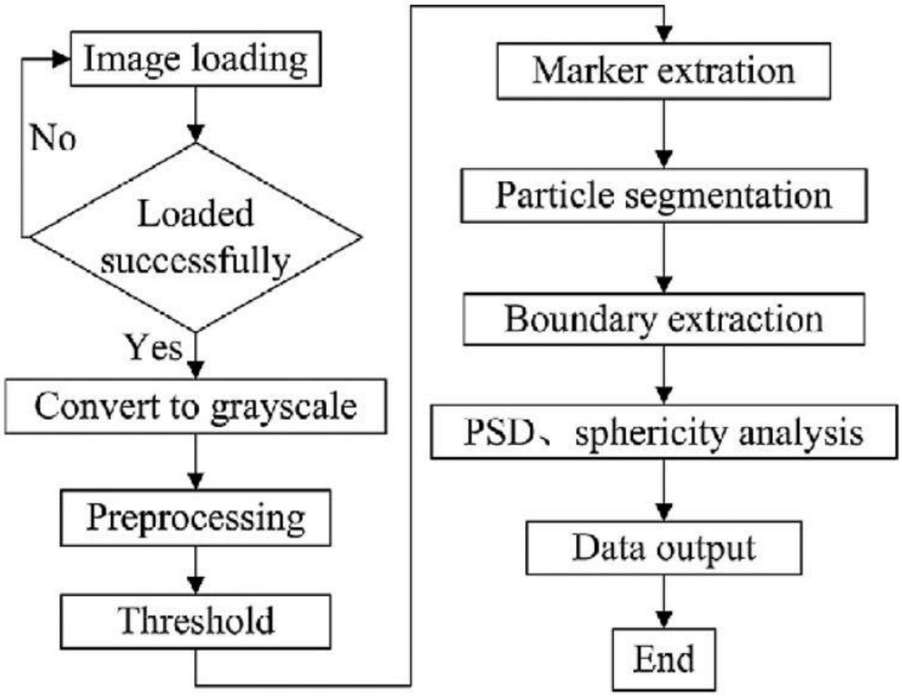


Fig. Flow Chart

4.2.2. CLASSDIAGRAM
Class diagram is a static diagram. It represents the static view of an application. Class diagram is not onlyusedforvisualizing,describing,anddocumentingdifferentaspectsofasystembutalsoforconstructingexecutable code of the software application. Class diagram describes the attributes and operations of a class and the constraints imposed on the system. The class diagrams are widely used in the modelling of object-oriented systems because they are the only UML diagrams, which can be mapped directly with object-orientedlanguages. Class diagram shows a collection of classes, interfaces, associations, collaborations, and constraints. Itisalsoknownasa structural diagram.
The purpose of class diagram is to model the static view of an application. Class diagrams are the onlydiagramswhichcandirectlymapwithobject-orientedlanguagesandthuswidelyusedatthetimeofconstruction.

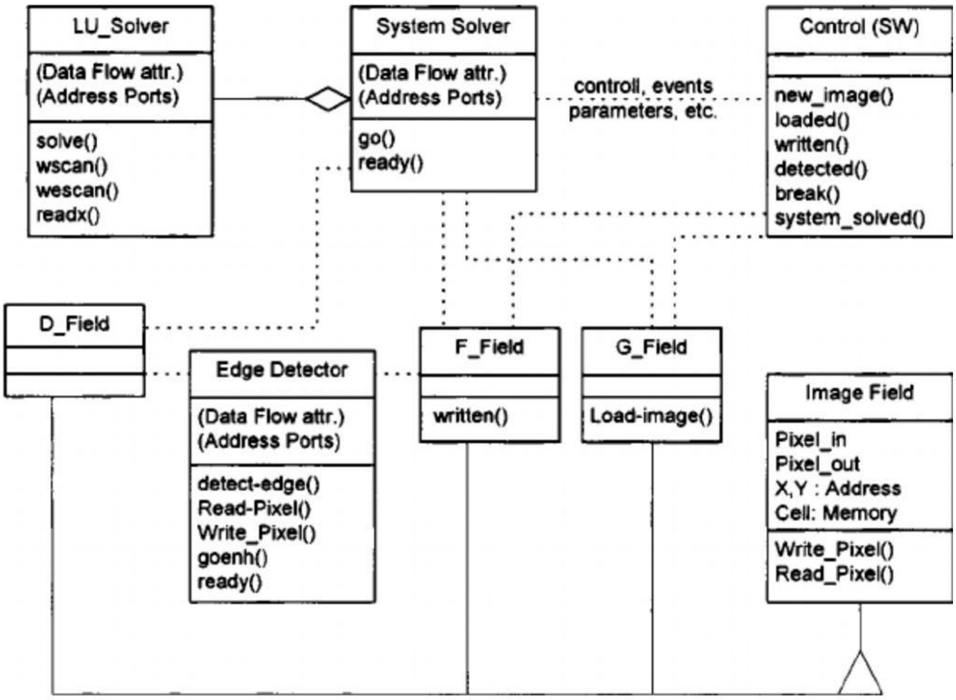


Fig. Class Diagram

4.2.3. USECASEDIAGRAM

A use case diagram is used to represent the dynamic behavior of a system. It encapsulates the system'sfunctionalitybyincorporatingusecases,actors,andtheirrelationships.Itmodelsthetasks,services,andfunctions requiredby a system/subsystem of an application. Itdepicts the high-level functionality of a systemandalsotellshowtheuserhandlesa system.

The main purpose of a use case diagram is to portray the dynamic aspect of a system. It accumulates the system'srequirement, which includes both internalas well as externalinfluences. It invokes persons, use cases, andseveral things that invoke the actors and elements accountable for the implementation of use case diagrams. Itrepresentshowan entity fromthe externalenvironmentcaninteract withapart of thesystem.

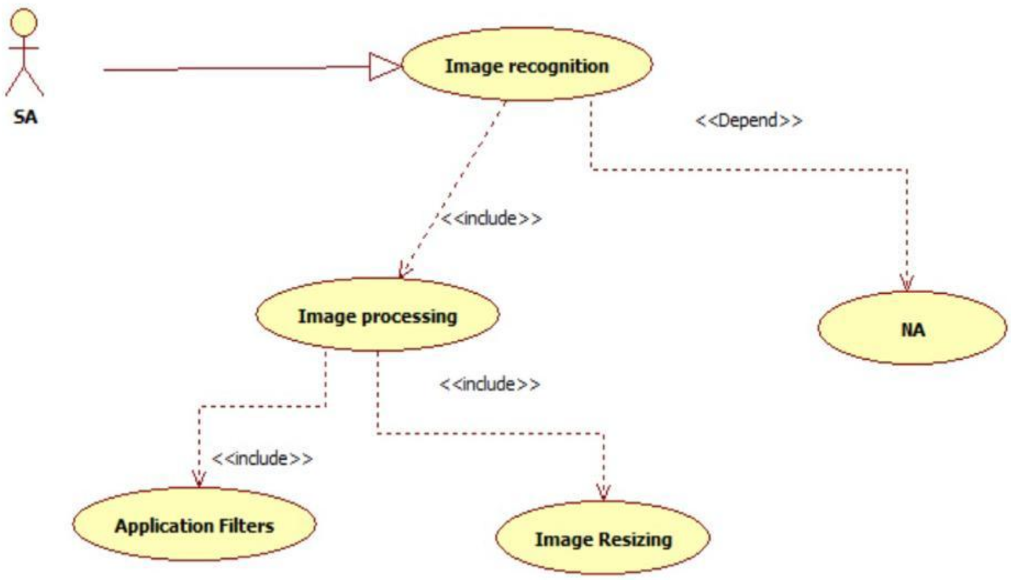


Fig.Usecasediagram

4.3.3. SEQUENCEDIAGRAM

The sequence diagram represents the flow of messages in the system and is also termed as an eventdiagram. It helps in envisioning several dynamic scenarios. It portrays the communication between any twolifelines as a time-ordered sequence of events, such that these lifelines took part at the run time. In UML, thelifeline is represented by a vertical bar, whereas the message flow is represented by a vertical dotted line thatextendsacrossthebottomofthepage.It incorporatestheiterationsaswell asbranching.

Thepurposeofsequencediagram:

To modelhigh-levelinteractionamongactiveobjectswithinasystem.Tomodelinteraction among objectsinsideacollaborationrealizingausecase. Iteithermodelsgenericinteractions orsomecertaininstancesofinteraction.

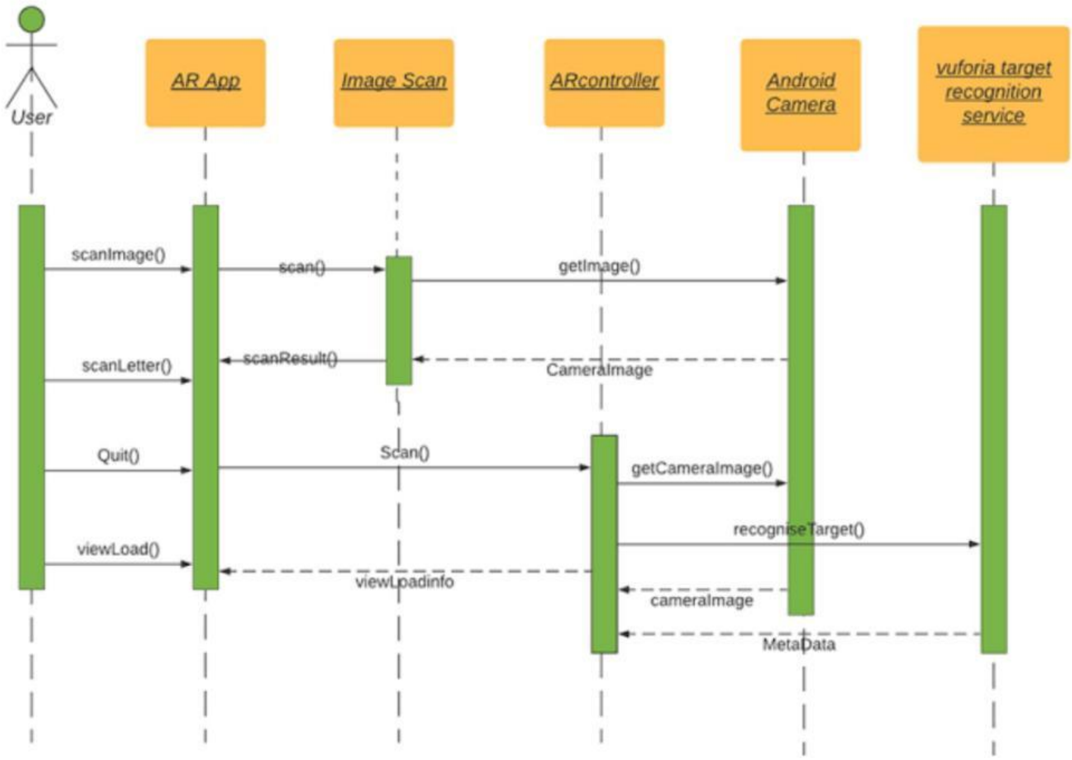


Fig. Sequence Diagram

4.3.4. BLOCKDIAGRAM:

A **block diagram** is a diagram of a system in which the principal parts or functions are represented by blocks connected by lines that show the relationships of the blocks.

They are heavily used in engineering in hardware design, electronic design, software design, and process flow diagrams.

Block diagrams are typically used for higher level, less detailed descriptions that are intended to clarify overall concepts without concern for the details of implementation.

Contrast this with the schematic diagrams and layout diagrams used in electrical engineering, which show the implementation details of electrical components and physical construction.

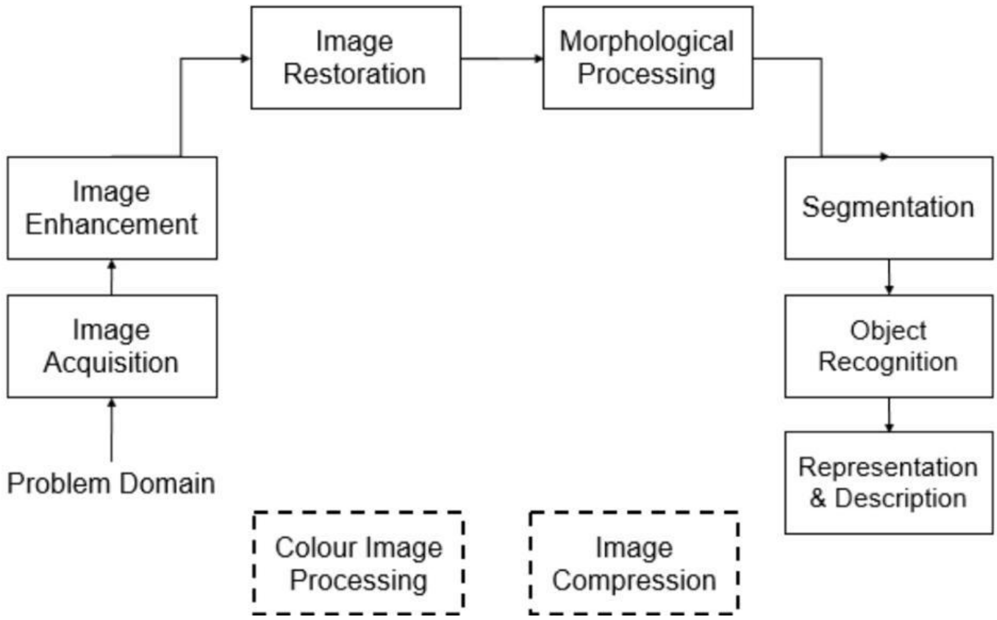


Fig.Block Diagram

5. TECHNOLOGIESUSED:

5.1. OPEN CV MODULE:

- OpenCV is **a Python open-source library, which is used for computer vision in Artificial intelligence, Machine Learning, face recognition, etc**.
- OpenCV (Open-Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built **to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products**.
- OpenCV is a great tool for image processing and performing computer vision tasks. It is an open-source library that can be used to perform tasks like face detection, objection tracking, landmark detection, and much more.
- OpenCV is **a Python library that allows you to perform image processing and computer vision tasks.**

5.2. PYTHON

- Python is commonly used for developing websites and software, task automation, data analysis, and datavisualization. Since it's relatively easy to learn, Python has been adopted by many non-programmers such asaccountants and scientists, for a variety of everyday tasks, like organizing finances.
- Python has **a wide selectionof libraries and frameworks**, which is one of the greatest advantages of Python. From NumPy to TensorFlowPython Library is used for everything from data visualization, machine learning, data science, natural languageprocessing,andcomplexdata analysis.

5.3. IMAGE PROCESSING

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too.
Image processing basically includes the following three steps:

- Importing the image via image acquisition tools;
- Analysing and manipulating the image;
- Output in which result can be altered image or report that is based on image analysis.

6. CONCLUSION

The topic of image processing has gained vital name and recognition among researchers because of theirfrequentlookinvariedandwidespreadapplicationswithinthefieldofvariousbranchesofscienceandengineering.A sanexample,imageprocessingishelpfultoissuesinsignaturerecognition,digitalvideoprocessing,RemoteSensingandf inance.

Identifying Mineral Ores and calculating their cost by huge machines is the general process which we perform usually. This may be a time-consuming process and a difficult task to e performed. So, to reduce this work and time load we can simply use Image Processing Method where we can use the image of the Mineral Ore and by scanning it we can find the coordinates of the Ore.

Early ways for calculating the cost of the ores can be performed but Image Processing can be an efficient and easy way. The main purpose of this project is to calculate the size, shape of the ore. OpenCV is **a Python open-source library, which is used for computer vision in Artificial intelligence, Machine Learning, face recognition, etc**

REFERENCES

[1]. https://issuu.com/irjet/docs/irjet-v7i1376
[2]. https://www.irjet.net/archives/V9/i5/IRJET-V9I5101
[3]. https://ieeexplore.ieee.org/document/4745633
[4]. http://ijmtst.com/volume7/issue05/10.IJMTST0705037
[5]. https://ieeexplore.ieee.org/document/7860045
[6]. https://www.science.org/content/blog-post/prehistory-cartoons