

# Coal Mines Security System

Ankita Guhe, Shruti Deshmukh, Bhagyashree Borekar, Apoorva Kailaswar ,Milind E.Rane

Department of Electronics Engg. Vishwakarma Institute of Technology(VIT),  
Pune,411037,INDIA

## Abstract

Geological circumstances of mine seem to be extremely complicated and there are many hidden troubles. Coal is wrongly lifted by the musclemen from coal stocks, coal washeries, coal transfer and loading points and also in the transport routes by malfunctioning the weighing of trucks. CIL —Coal India Ltd is under the control of mafia and a large number of irregularities can be contributed to coal mafia. An Intelligent Coal Mine Security System using data acquisition method utilizes sensor, automatic detection, communication and microcontroller technologies, to realize the operational parameters of the mining area. The data acquisition terminal take the PIC 16F877A chip integrated circuit as a core for sensing the data, which carries on the communication through the RS232 interface with the main control machine, which has realized the intelligent monitoring. Data management system uses EEPROM chip as a Black box to store data permanently and also use CCTV camera for recording internal situation. The system implements the real-time monitoring and displaying for data undermine, query, deletion and maintenance of history data, graphic statistic, report printing, expert diagnosis and decision-making support. The Research, development and Promote Application will provide the safeguard regarding the mine pit control in accuracy, real-time capacity and has high reliability.

**Keywords:** Coal mine security system; character recognition ,number plate recognition, load cell, intelligent decision-Making support.

## 1. Introduction

In a Coal mine there are two types of security needed one for human being and another for production because coal enterprise is the high-risk profession and technique which is relatively backward. Security is the most important factor in the coal mine production. Establishing mine safety production safeguard system is the only way to guarantee the safety in coal mine production. Currently in mine production, there are mainly following aspects to impact the safety in mine production: Environment Parameters: Gas, Carbon Monoxide, Temperature (Humidity) Degree, Coal Position of the Bunker, Pressure of the roof etc. Electromechanical Device Running

Parameters: transport fix, belt conveyer, Voltage, Electric Current and so on [1]. Neural network is essentially a nonlinear transformation system of information which possesses a strong non-linear processing capability and a wide range of adaptability, learning ability and mapping capability [2]. Thus a trained neural network is competent to self-coordinate the weight of all the evaluation indicators with no need to go as the traditional ways do.

In summary, An Intelligent Coal Mine Security System using Data acquisition systems is the significant measure that safeguards the safe production in coal mine[3]. Thus this method is used to recognize the number plate of the truck which is used for transporting the coal as well will record the quantity of the coals and thus preserve the coal mines and thus improving its security.

## 2. System Summarization

A Coal Mine Security System using Data acquisition Method mainly monitors the parameter such as quantity of coal extracted and to be transported, the time of loading the coal in the truck and so on as well as the main production equipment stop the switch parameter, forecast mine production security information, effectively avoid the malignant accident[4]. Compared with the former system, this system subordinate controls computer and uses the intelligent load cell with increased precision of the data acquisition, the expert system module can provide the solution way when the mine exceptional operation is considered. Hardware part of the system is comprised of data acquisition terminal, data concentrator and main control computer. Software part of the system is comprised of Mine Monitoring Data Management system based on MATLAB, it is used for integrated management and monitoring of the whole mining area. The whole system will transfer the real data to main control computer monitoring program through the serial communication interface, to display, store, query and print the mine quantity in the hard disk as well as record the image of the number plate using web cam.

### 3. System Hardware Structure

In this system a microcontroller will read the analog output of a load cell. The output of the load cell is amplified and then given to the microcontroller A to D converter. Microcontroller displays on LCD and sends this data to a pc through serial communication. A MATLAB based software is used to receive the data from the microcontroller. When the new data is received from the microcontroller a snap of the number plate is taken and stored in the pc hard disk. Also the weight is also stored in the hard disk. Here a microchip based microcontroller is used which has built in 10 bit ADC. A web cam is used to take pictures of the number plate of the vehicle. A MATLAB based graphic user interface is used .A XP based system is used for pc.

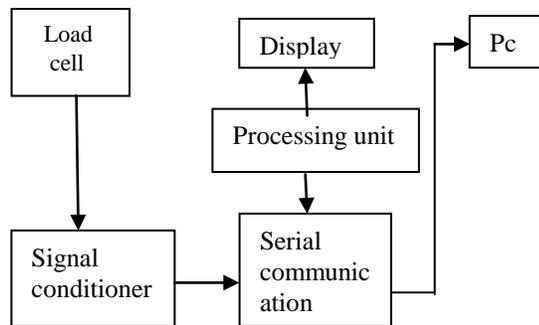


Fig.1. Block diagram of security system



Fig.2. The exporting of coal in mines

The procedure in the data gathering terminal uses the PIC language to compile mainly completes following several function: Each kind of sensor analog parameter gathering and A/D transformation, the data reads. Gathering the value of open, stops, switch quantity and other electrical parameter to control system. Data computation and memory, warning judgment, power source management and system self-check. Carries on the data exchange with the concentrator taking the power line

as the medium through the carrier communication. To be possible to carry on the local data through the local serial port to copy reads and the parameter establishment.

### 4. System Overall Structure

#### 4.1 System Main Control Software Modular Structure

The main control software part of the overall system installs on the main terminal computer as well as the subordinate substation various labour controls machine. The main interface is coded by using MATLAB. The real-time data acquisition display module has implemented the acquisition and display of all changed data of the entire mining area; The history data inquiry and the maintenance module can be used to manage and maintain all the collected data; The statistical history data graph module can be used to analyze and compare the historical data; The display and printing data report module is used to print the mine data form.

#### 4.2 Automatic License Plate Recognition System

License plate recognition (LPR) is a form of automatic vehicle identification. It is an image processing technology used to identify vehicles by only their license plates. Real time Since every vehicle carries a unique license plate, no external cards, tags or transmitters need to be recognizable, only license plate. The proposed algorithm consists of three major parts: Extraction of plate region, segmentation of characters and recognition of plate characters[5].

##### 4.2.1 Structure of the LPR system

The algorithm proposed in this paper is designed to recognize license plates of vehicles automatically. Input of the system is the image of a vehicle captured by a camera. The captured image taken from 4-5 meters away is processed through the license plate extractor with giving its output to segmentation part. Segmentation part separates the characters individually. And finally recognition part recognizes the characters giving the result as the plate number.

##### 4.2.2 Plate region extraction

Plate region extraction is the first stage in this algorithm Image captured from the camera is first converted to the binary image consisting of only 1's and 0's (only black and white) by thresholding the pixel values of 0 (black) for all pixels in the input image with luminance less than threshold value and 1 (white) for all other pixels. Captured image (original image) and binarized image are shown in Figure 3(a) and 3(b) respectively.



Fig 3( a ) Captured image



Fig 3(b) Binarized Image

To find the plate region, firstly smearing algorithm is used. Smearing is a method for the extraction of text areas on a mixed image. With the smearing algorithm, the image is processed along vertical and horizontal runs (scan-lines)[6].

If the number of white pixels is less than a desired threshold or greater than any other desired threshold, white pixels are converted to black. In this system, threshold values are selected as 10 and 100 for both horizontal and vertical smearing.

If number of 'white' pixels  $< 10$  ; - pixels become 'black'  
Else ; - no change. If number of 'white' pixels  $> 100$  ; pixels become 'black' Else ; no change

After smearing, a morphological operation, dilation, is applied to the image for specifying the plate location. However, there may be more than one candidate region for plate location. To find the exact region and eliminate the other regions, some criteria tests are applied to the image by smearing and filtering operation.

The processed image after this stage is as shown in Figure 4(a) and image involving only plate is shown in Figure 4(b).

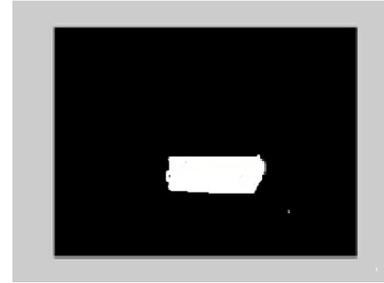


Fig 4( a ) Plate region



Fig4( b ) Image involving only plate

### 4.2.3 Segmentation

In the segmentation of plate characters, license plate is segmented into its constituent parts obtaining the characters individually. Firstly, image is filtered for enhancing the image and removing the noises and unwanted spots. Then dilation operation is applied to the image for separating the characters from each other if the characters are close to each other. After this operation, horizontal and vertical smearing are applied for finding the character regions. The result of this segmentation is in Figure 5.



Fig. 5. Locations of plate characters

The next step is to cut the plate characters. It is done by finding starting and end points of characters in horizontal direction.

### 4.2.3 Character Recognition

Before recognition algorithm, the characters are normalized. Normalization is to refine the characters into a block containing no extra white spaces (pixels) in all the four sides of the characters.

Fitting approach is necessary for template matching. For matching the characters with the database, input images

must be equal-sized with the database characters. Here the Characters are fit to 36 18. The extracted characters cut from plate and the characters on database are now equal-sized. The next step is template matching. Template matching is an effective algorithm for recognition of characters. The character image is compared with the ones in the database and the best similarity is measured.

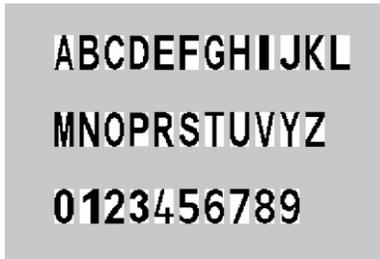


Fig. 6. The database characters

Because of the similarities of some characters, there may be some errors during recognition. The confused characters mainly are B and 8, E and F, D and O, S and 5, Z and 2. To increase the recognition rate, some criteria tests are used in the system for the confused characters defining the special features of the characters. With these features of characters and applied tests during recognition algorithm, recognition rate is increased with the minimum error.

## 5. Experimental Results

Experiments have been performed to test the proposed system and to measure the accuracy of the system. It captures the license plate of the truck. The system is designed in MATLAB 7 for recognition of license plates. The images for the input to the system are colored images with the size of 1200 1600. The test images were taken under various illumination conditions. The results of the tests are given by Table 1.

Table 1. Result of The Test

Units of LPR system	Number of accuracy	Percentage of accuracy
Extraction of plate region	332/340	97.6%
Segmentation	327/340	96%
Recognition of character	300/340	88.26%

When the truck enters in the mines the weight is recorded

using load cell which gives an accuracy of 94-95 %, it is then stored in the hard-disk as well displayed on the LCD. In our system weight is calculated in terms of KG but in practical system it is calculated in terms of Tones (1 Tone=1000 KG).It is shown that accuracy for the extraction of plate region is%97.6, %96 for the segmentation of the characters and %88.26 is the percentage of accuracy of the recognition unit. The overall system performance can be defined as the product of all units accuracy rates (Extraction of plate region segmentation of characters and recognition of characters). Recognition Rate of LPR System = (Percentages of Accuracy) (2).

## 6. Conclusions

Utilizing technology such as automatic detection Technology, communication technology and microcomputer technology, to realize the operational parameter intelligent monitored management of entire mining area, this system occupies following characteristic: The real-time data warning. The warning displays with kinds of representation. Using industry camera, it carries on image gathering and the remote control. Establish the real-time monitor security information data platform, Using the MATLAB, making the system safety, convenient processing each kind data. This intelligent Coal Mine Monitor System satisfies the user's request in the field of mine pit production condition real-time monitoring and dangerous situation discovery and elimination promptly, provides a novel monitor method for the middle and small scale coal mine; Thus ultimately preserving the coal which is most beneficial element for generating electricity.

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7. **Authors:**



Ankita Guhe:- Pursuing B.Tech in electronics engineering. Executive committee member of IEEE. Member of ISTE and IETE Assosiation. Achieved 2<sup>nd</sup> prize in national level technical paper presentation

in VJTI,Mumbai.



Shruti Deshmukh:-Pursuing B.Tech in electronics engineering. Member of IEEE and IETE .



Bhagyashree Borekar:- Pursuing B.Tech in electronics engineering. Member of The Robotic Forum.



Apoorva Kailaswar:- Pursuing B.Tech in electronics and telecommunication engineering. Member of IEEE.



Milind E Rane : received his BE degree in Electronics engineering from University of Pune and M Tech in Digital Electronics from Visvesvaraya Technological University, Belgaum, in 1999 and 2001 respectively. His research interest includes image processing, pattern recognition and biometrics recognition.