calculated on the title block. There is a case rejected, especially because of the difficulty with the frames and the region of the title block, which part of it is being erased or perpendicular.

A research done [7] suggested an automatic system analysis in extracting structured knowledge from an engineering drawing table. The technique could analyse the layout of the drawings and extract the physical and logical structure. Based on the automatic analysis, this research suggested normalization method in the integration between the varieties of engineering tables compared to the engineering drawings in extracting the knowledge domain within. Besides that, this research successfully did search on straight lines from raster images with the use of Global Line Vectorization which suggested by previous researchers. With the application of this algorithm, the text could be recognized after identify the straight lines and symbols omitted from the drawing images. Based on the mean distance extracted from the straight lines nearby and parallel, the size could be determined in searching of the connected character box. The extraction of the straight lines nearby could be the guidance in search processes because of most of the text in en engineering drawing blocks are serial or parallel with the table lines. The weakness in this research is that it could not detect parallel and perpendicular lines which might contain errors.

Y. Cao et al. (2005) [8] had produced a methodology to control a version automatically which concentrate on the automatic version identification. The methodology applied is by analyzing the layout of a square region from a drawing frame and the information related to the version then is extract with the help of keywords defined in the database. Three major steps in analyzing a layout of a rectangular are by, firstly is to identify the rectangular positioned at the below left or right of the drawings. The rectangular is made from a group of rectangular and followed according to the keywords defined in the database found at the square. However, the weakness of the methodology is that it will analyze one-by-one, the region of the rectangular of the whole drawing and make sure of the keywords had been defined or not. This method is time consuming as it has to scan the whole drawing where there are a lot of rectangular needs to be analyzed. The proposed technique in this research extracts version information in a drawing frame using a model-based method. When a new drawing is introduced to the system, it selects a predefined pattern most similar to the drawing frame used in the new drawing and extracts the information based on the selected pattern. However, the technique is not suitable for engineering drawings with different layout plan because predefined patterns should be prepared and implanted into the system before version extraction. It takes a lengthy time for the system to find the appropriate pattern. Moreover, if the frame pattern of new drawing does not exist in the predefine pattern located in the database, the system fail to do the extraction process which does not suit the variability of title block structures.

Meanwhile Mahmood (1999) [13] addressed the problem of extracting indexing keywords from engineering drawing images by localizing image structures called title block. In order to locate title block, they used technique of 2D pattern localization in unsegmented images called location hashing. The weakness of this technique is it unable to locate title block which has different layout plan as it requires a learning step to establish a model for each structure to locate.

Ondrejcek et al. (2009) [14] had suggested an automatic found system from an unknown relationship between engineering drawing files and 3D CAD models. In this research, engineering drawings is in the form of images where the scanning process is done where the resolution applied is less than 300dpi. The title block is identified manually on the engineering drawings and contains a cropped title block. The cropped title block is identified according to the type and is compared to the existing template. However, the system has limitation due to the usage of the template in determining the type of a title block. If it is found out that the title block is not suitable to the template, the title block could not be identified and the information extracting process failed to execute. Table 1 compares the information extraction methods of engineering drawing tables from previous researchers.

ITEM NO.	PART NUMBER	DESCRIPTION	C0/QTY.	C1/QTY.	C2/QTY.
1	8112156	Handle	1	1	-
2	8112174	Handle-shoulder	1	1	-
3	8113199	End cap	1	1	-
4	9113155	Embedded bolt	1	1	1
5	8112992	Housing	1	1	1
6	8116170	Gearshaft screw	1	-	1
7	112-135	Crescent washer	1	1	1
8	112-139	Shaft screw	1	1	1
9	113-144	Shaft spring	1	1	1
10	8112188	Shaft	1	1	1

Fig 2: Example of bill of materials

REV	ZONE	REVISION DESCRIPTION	DATE	APPR
A	ALL SHTS	INITIAL RELEASE	12/05/05	
B	PG2 C-2	ADDED ADDITIONAL MOUNTING POINTS	12/05/05	
C	PG2 A-1	ADDED ACCESS PANEL IN BULKHEAD	01/02/06	

Fig 3: Example of revision block