**CHAPTER II  
BASIC OF THEORY**

**II.1 Definition of Barcode**

Barcode is an optical machine-readable representation of data relating to the object to which it’s attached. Barcode can be described as an optical Morse code. It’s the small image of lines (bars) and spaces that is affixed to identification the information. Barcodes originally were scanned by special optical scanners called barcode readers. The code uses a sequence of vertical bars and spaces to represent number and other symbols are read with a scanner that turned into a line of text for your device, which measures reflected light and interprets the code into numbers and letters that are passed on to a device­.

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**Figure 2.1 Example Linear Barcode from some product (REF: http://bygpub.com / )**

A barcode essentially is a way to encode information in visual pattern that a machine can read the combination of white and black bars represents different text character which follows a set algorithm for that barcode type, if you change the sequence of bars, you will get the different of text from that barcode.

Originally barcodes systematically represented data by varying width and spacing of parallel lines and may be referred to linear barcode (1D) and then evolved into rectangles, dots, hexagons and other geometric patterns barcode (2D) and now is 3 Dimension barcode. Barcode symbol typically consist of five parts is a quiet zone, a start character, data characters, a stop character and another quiet zone. Barcode can hold any type of text information that you encode but with the product labels the price in not usually encoded.

Barcode will denote what product its and your POS software like cashier or database will have pricing information associated to this. At the Point Of Sale (POS), shoppers can get product discounts or special marketing offers through the email address or home address provided at registration. Depending on the specific barcode type, Linear Barcodes can have from 20-25 Characters then Matrix Barcode go up to 2000 Characters, if increase the amount of information, the barcode will became more bigger.

The Symbologies of the barcode technology can be arranged or mapped in a variety of ways, Continuously Symbology and Discrete Symbology. A continuous symbology is marked by the characters beginning with a black line and ending with a white line or space, discreet symbologies have characters encoded as a black line a space and then another black line. In Discrete Barcode, character begin and end with bars and the space between characters will be ignored by scanner. In Continuous Linear Barcode, each character begins with a bar and ends with a space, allowing characters to be strung together continuously.

The GS1 DataBar barcode symbology is the latest barcode type for space-constrained identification from [GS1](http://www.gs1.org/), formerly EAN International and the Uniform Code Council, Inc. DataBar barcodes have been utilized to solve many problems in POS, grocery and healthcare, where items are too small to allow for traditional barcode types, or where additional information needs to be encoded such as product weight, expiration dates, country of origin or serial numbers.

### II.2 History Barcode

Supermarkets is precious business. They must stock thousands of product of brands and sizes to sell at painfully small markups. Keep close track and maintaining inventories neither too large nor too small is critical. Those expensive and cumbersome job was usually done no more than once a month. The Manager Store had to base most of decision on hunches or crude estimates.

Long before barcodes and scanners were actually invented, grocers knew they desperately needed something like them. In 1890, first developed of punch cards for US Census seemed to offer some early hope. In 1932. Wallace Flint, a business student was wrote a thesis in which envisioned a supermarket where customers would perforate card to mark their selection, in the counter, they would insert them into the reader, which activated machinery to bring the purchases on conveyer belts. Store management will record of what was customer being bought. The problem is, the card reading equipment was bulky, utterly unwieldy and so expensive.

In 1948, first step of barcode technology was come when *Bernard Silver*, a graduate student overheard a conversation in the halls of Philadelphia’s Drexel Institute of Technology. The president of food chain was pleading with one of the dean to undertake research on capturing product information automatically at checkout. The dean turned down the request, but Silver mentioned the conversation to Norman Joseph Woodland, graduate student and teacher at Drexel and also the friend of Silver.

The first idea is to use patterns of ink that will glow under ultraviolet light and their built a device to test that concept, and it worked! In other side, their encountered with problem of ranging from the ink instability to printing costs. Later, Woodland took some stock market earnings of quit Drexel and moved to his grandfather’s apartment in Florida to seek the solutions. The work is made a result after several month trying and try, in result, Woodland make the Linear Barcode using elements from two established technologies, movie soundtracks and Morse code.

From 1920, Woodland made use out of Lee de Forest movie sound system to read the data of Linear Barcode. De Forest had printed a pattern of varying degrees of transparency on the edge of the film and then shone a light through it’s as the picture ran. A sensitive tube on the other side translated the shift in brightness into electric waveforms which were in turn will converted into sound by the loudspeakers. After know that, Woodland planned to adapt those system by reflecting light off his wide and narrow lines and using a similar tube to interpret results.

In 1932 an ambitious project was conducted by small group of students headed by Wallace Flint at the Harvard University Graduate School of Business Administration. The project proposed that customers select desired merchandise from a catalog by removing corresponding punched cards from the catalog. Then the puched cards were then handed to a checker who placed the cards into a reader. The system then pulled the merchandise automatically from the storeroom and delivered it to the checkout counter, a complete customer bill was produced and inventory records were updated.

In 1949, Woodland took back his idea to Drexel, he began putting together a patent application, decided to replace his wide and narrow lines with concentric circles so that will be scanned from any direction, that’s technique became known as bull’s eye code. So Silver investigated what the form of the bull’s eye codes should ultimately take. In 1952, Woodland and Silver Patent Application was issued as US Patent 2,612,994. In 1962, Silver Died at age 38 before having seen the commercial use of barcode.

Until 1966, Barcode was not commercialized. National Association of Food Chains put out a call to equipment manufacturers for system that would speed the check put process. In 1967, RCA installed one of the first scanning system at a Kroger Store in Cincinnati. The product codes were represented by bull’s eye barcode, a set concentric circular bars and spaces of varying widths. In 1969, NAFC asked Logicon Inc. to develop a proposal for industry-wide barcode system.

In 1970, the result of proposal NAFC (National Association of Food Chains) is Parts 1 and 2 of the Universal Grocery Product Identification Code (UGPIC). Based on the recommendations of the Logicon report, the US Supermarket Ad Hoc Committee on a Uniform Grocery Product Code was formed. In 1973, US Supermarket Ad Hoc Committee recommended the adoption of the UPC symbology set in other time, Kroger Corporation take the practice as test the Universal Product Code (UPC) and used a system of bull’s eye patterns instead of the parallel line patterns that used to. In 1974, all the test were done, all proposals were complete all standards were set and the first UPC scanner was made by NCR Corporation was installed at Marsh’s supermarket in Troy, Ohio. And also the first product with barcode was scanned at a check-out counter and it was a 10-pack of Wrigley’s Juicy Fruit Chewing Gum.

### II.3 Definition of Linear Barcode

Linear Barcode is the first generation of barcode or can be called One Dimensional Barcode, Linear Barcode is typical “Picket Fence” style barcode is made up of lines and spaces of various widths that create specific patterns that represent Stock-Keeping Unit (SKU) numbers which are easily and quickly read by barcode scanners, all information in the barcode are organized horizontally from the left to the right of code except from the bottom to the upper of code, it’s not contain any information.

**Figure 2.2 Linear Barcode Example Code** **(REF:** [**http://en.wikipedia.org/wiki/Barcode**](http://en.wikipedia.org/wiki/Barcode)**)**

Linear Barcode, the information inside the code is linearly, encoded with intervals of alternating diffuse reflectivity (highs and lows signal-wise), usually black and white in color. Interval are actually stored as rectangles whose vertical height carry no information but facilitates the scanning process and electronically corresponds to the actual bars and spaces of the symbol.

Linear Barcode have variety of symbologies (barcode) type, these symbologies work in the same way, although different symbologiest of Linear Barcode may change the appearance of the letter, the information include that barcode will never be effected. Linear codes, in which character are grouped one next to another character in one linear direction. Simply, put a single row of parallel bars and spaces, only width of bars and sometimes spaces are measured to interpret the symbol. The height of the code is simply redundancy to enable scanners to more easily scan the symbol.