CHAPTER 2

LITERATURE REVIEW

As adulteration plays a vital role in day-to-day life, it is necessary to avoid adulteration. Research is going on throughout the world to avoid adulteration. Though the researchers came out with some outcomes there are some drawbacks. Some of the solutions and the drawbacks are stated here.

2.1 FOOD ADULTERATION IDENTIFICATION

Nidhi Gupta et al. [33] planned to identify buying practices of homemakers and their extent of awareness related to selected food products. Stratified sampling method with questionnaire cum interview schedule was adopted to collect data. Tool was standardized by difficulty index, validity index and split half reliability method. Statistical test such as chi-square between awareness and occupation, t-test among age group, educational level and extent of awareness were carried out. Study revealed that respondents’ awareness related to rights and responsibilities was good but poor related to food adulteration. Education, family income and occupation had an effect on extent of awareness. Age and awareness has no correlation while a positive correlation was found between family income and awareness.

Lakshmi, [27] discussed Food is adulterated to increase the quantity and make more profit. The food is sucked of its nutrients and the place where the food is grown is often contaminated. For example: Milk is mixed with water. Vanaspati is used as an adulterant for ghee. Ergot is used as an adulterant for cereals. Chalk-powder is used as an adulterant for flour. Chicory is used as an adulterant for coffee. Papaya seeds are used as an adulterant for pepper. Brick-powder is used as an adulterant for chilly-powder.
Tamarind seed powder is used as adulterant for coffee. Wood powder is adulterated for turmeric and dhaniya powder.

Sitaram Dixit, [44] presented Food adulteration is a growing menace that unscrupulous traders and manufacture all over the world indulge in to exploit gullible consumers to make quick and easy money. In all free market societies where legal control is poor or nonexistent with respect to monitoring of food quality by authorities, usage of adulterants is common and rampant. Every nation on earth has suffered cases of adulteration at one time or other. Government authorities with great efforts have succeeded in reducing the recurrent occurrences; but have not been able to eliminate it. Only an aware and an informed consumer will be able to eliminate it conclusively by continuous routine monitoring. The dictionary defines food adulteration as an act of intentionally debasing the quality of food offered for sale by either the admixture or substitution of inferior substances or by the removal of some valuable ingredient.

2.2 OIL ADULTERATION IDENTIFICATION

Dourtoglou et al. [11], discussed a Curie-point pyrolysis mass spectra obtained from a variety of extra virgin olive oils, prepared from various cultivars using several mechanical treatments. Some of the oils were adulterated (according to a double-blind protocol) with different amounts of seed oils (50-500 ml of soya, sunflower, peanut, corn or rectified olive oils per litre of mixed oil). Canonical varieties analysis indicated that the major source of variation between the pyrolysis mass spectra was due to differences between the cultivars rather than the oils had been adulterated. However, artificial neural networks could be trained (using the back-propagation algorithm) successfully to distinguish virgin oils from those which had been adulterated.
Vigli et al. [55] explained about the potential of Raman spectroscopy and compared it with the results achieved in infrared spectroscopy. The discrimination of virgin olive oil from other edible oils, and the detection and quantification of virgin olive oil adulteration have been experimented with this new technique of fast and non-destructive analysis.

Mildner-Szkudlarz et al. [30] used an electronic nose for the detection of maize oil adulteration in camellia seed oil and sesame oil. The results of multivariate analysis of variance showed that the sensor signals of different kinds of oil are significantly different from each other. Principal Component Analysis (PCA) cannot be used to discriminate the adulteration of camellia seed oil, but can be used in the discrimination of adulteration in sesame oil. Linear Discriminate Analysis (LDA) is more effective than PCA and can be used in adulteration discrimination for both camellia seed oil and sesame oil. In order to check the discriminative power of LDA, canonical discriminate analysis was performed as well. Acceptable results were also obtained. The accuracy of prediction was 83.6% for camellia seed oil and 94.5% for sesame oil. The Artificial Neural Network (ANN) model was used to detect the percentage of adulteration in camellia seed oil and sesame oil. The results showed that, based on ANN as its pattern recognition technique, the electronic nose cannot predict the percentage of adulteration in camellia seed oil, but can be used in the quantitative determination of adulteration in sesame oil.

Vandana Mishra, [53] have explored unsupervised models for the identification of edible and vegetable oils and to detect adulteration of Extra Virgin Olive Oil (EVOO) using the most common chemicals in these oils such as saturated fatty, oleic and linoleic acids. The optimization and validation processes of the models have been carried out using bibliographical sources. A database for developing learning process and internal validation, and six other different databases to perform their external validation have been used. In the worst of the cases, the unsupervised models are able to classify more than 94% of samples
and detect adulterations of EVOO with promising results. The adulteration of EVOO with corn, soya, sunflower and hazelnut oils can be detected when their oil concentrations are higher than 10, 5, 5 and 10 %, respectively.

### 2.3 MEASUREMENT OF MOISTURE

King, R.J et al. [26] proposed two independent, two-parameter techniques developed for online, *in situ* measurement of the bulk moisture content of grains using microwaves. The first is noncontacting 4.9-GHz system configured so that a well-collimated TEM (transverse electromagnetic) beam is transmitted through a layer of grain, e.g., moving on a conveyer or flowing in a chute. The changes in attenuation and phase serve as two independent measurement parameters from which the wet and dry basis weights (g/cm$^2$) and moisture can be found using a linear model, independent of the layer thickness. If the layer thickness is also known, the wet and dry densities (g/cm$^3$) and complex dielectric constant can also be found. The second technique uses a contacting resonator sensor which can be conformably mounted or used as a portable probe. In this case, the two independent measured parameters are the resonant frequency and the input mismatch (coupling) factor. Using an analytical model of the sensor, the complex dielectric constant of the grain is determined and then used to find the grain moisture content and density.

Nelson, S.O et al. [32] proposed the importance of moisture measurement in grain and seed. A brief history of the development of moisture sensing instruments, based on sensing electrical properties of these materials is also presented. Data are presented graphically on the permittivities or dielectric properties of grain and seed showing their variation with frequency, moisture content, temperature, and bulk density, and references are cited for further information. More recent developments on microwave measurements...
for moisture content and bulk density sensing are briefly described, and numerous studies are cited providing sources of information on these techniques.

Yuying Jiang et al. [60] proposed a new method of grain moisture content measurement in granary. It is based on the measuring principle and characteristics of microwave moisture content determination techniques. According to the relationship between the power attenuation, signal parameter variation and moisture content of grain when the microwave penetrates the grain, a model of grain moisture content measuring was established. Experiments are made to compare with the traditional method on solving this problem. The results show that this method can measure the grain moisture content quickly and efficiently, and satisfy the requirement of grain moisture content determination in granary.

2.4 MEASUREMENT OF DISPLACEMENT

Chuan Zhong et al. [10] proposed a measurement system of plane displacement in rigid body. Plane displacement was calculated by the cross-correlation of speckle image. Measurement results showed that the absolute-error and the opposite-error of the plane displacement were less than ±14 μm and ±6.25% respectively, under the displacement range of 300 μm.

Norgia et al. [34] developed a self-mixing laser interferometer for the measurement of displacements on a generic target surface. The measurement is based on the bright-speckle tracking, a technique they have recently proposed to solve amplitude fading associated with the speckle statistics when the displacement to be covered is well in excess of the speckle longitudinal size. They implemented the dynamical tracking of speckle maxima with piezo actuators and a phase-sensing loop. Also, they used an automatic gain control, based on a liquid crystal attenuator, to improve the amplitude statistics. Details of
digital signal acquisition with adaptive signal processing through a field programmable gate array are discussed. The resulting instrument offers sub-μm resolution in the measurement of displacement up to 500 mm of total shift, has virtually no need for alignment and has very relaxed target-surface requisites, yet works with a very simple and inexpensive set-up.

2.5 MEASUREMENT OF SPEED

Gao Hon-Jun et al. [16] proposed the feasibility of a simple imaging technique for measuring vehicle speed. The camera axis was perpendicular to the road and a single interlaced frame was captured by a frame store. The basis of the speed measurement method is the comparison of just two consecutive half frames, using a matching technique to determine the displacement of the vehicle between consecutive half frames. Using a conventional video camera, these images were significantly blurred, although this did not hinder the procedure for determining the pixel displacement. From the displacement, the vehicle speed was determined from known vehicle dimensions. Reasonable agreement was obtained between speed observed on the speedometer and speed calculated from the speed and scale data. Since the image pair is created by separating the interlaced picture into half frames, the separated images must be aligned by one scan line to achieve a proper correlation. For both half frames, each empty line was filled by repeating the previous active scan line to make a full 512×512 image.

He Zhiwei et al. [20] proposed the rapid development of hardware technology to make it possible for computers or even micro-computers to handle the problem of traffic information gathering utilizing image/video processing and pattern recognition. In order to measure the speed of a vehicle, several models are proposed in this paper. Firstly, the background subtraction method with a proper background updating model is used to detect
the moving vehicle, whose position in the image is then traced with the obtained distinct features. The real position of the vehicle in the world coordination system corresponding to the traced pixel position can then be calculated according to one of the two proposed imaging models in the paper. With the real distance and the time period between successive image frames obtained, the speed of a vehicle can then be calculated easily. The proposed models are used in an embedded traffic information gathering system and results show the convenience and the high accuracy of the proposed methods.

Thuy Tuong Nguyen et al. [51] based on the camera calibration principle of Tsai's two stage method, a vehicle speed measurement method by video was put forward and the error analysis of camera calibration and vehicle speed measurement were carried out by. Firstly, the internal and external parameters of the camera were gained based on Tsai's two stage method. Secondly, the displacement offset of the same vehicle's feature point in every image was extracted and converted to the world coordinate system. Lastly, instantaneous velocity of the vehicles was carried out based on the time difference between two sequential frames. Experimental result shows that the vehicle speed measurement method in this paper is not only simple and practical but also highly robust and accurate. In a word, the speed measurement method can fulfill the requirements in the vehicle speed measurement system by video.

Vision-based vehicle speed measurement (VSM) is one of the most convenient methods available in intelligent transportation systems. Existing methods use an uncalibrated camera to measure vehicle speed, but they do not consider the possibility of camera vibration that leads to poor measurement results. Steger et al. [47] considered the issue when the camera is tilted downward and mounted at a fixed location on a bridge crossing the target street. The camera may vibrate due to wind or bridge movement. A vision-based speed measurement system is described in this paper, along with the vertical-
and-horizontal-histogram-based method, which is used to compensate the background of an incoming image. This novel method is utilized to eliminate noise coming from the displacement between an incoming image and a background image that is caused by camera vibration over time [62]. Moreover, a method is presented to automatically detect the vanishing point based on the Hough transform and quad tree. Experimental comparisons of the system to those of the vehicle’s own speedometer show that the proposed approach yields a satisfactory estimate of vehicle speed.

2.6 TILES QUALITY TESTING

Atiqur Rahaman, [1] discussed that quality control was an important issue in the ceramic tile industry. On the other hand maintaining the rate of production with respect to time is also a major issue in ceramic tile manufacturing. Again, price of ceramic tiles also depends on purity of texture, accuracy of colour, shape etc. Considering these criteria, an automated defect detection and classification technique was proposed that can have ensured better quality of tiles in the manufacturing process as well as production rate. The automated classification method was used to detect the defects and to control the quality of ceramic tiles. This automated classification method helped to acquire knowledge about the pattern of defect within a very short period of time and also to decide about the recovery process so that the defective tiles may not be mixed with the fresh tiles.

Zeljko Hocenski et al. [63] proposed a ceramic tiles failure detection based on FPGA image processing for tile surface and texture diagnosis. Final stage of tile manufacturing deals with surface and edge defects detection and is still not an automated part of production. Computer visual diagnosis and FPGA-based embedded hardware digital design were used to classify tiles according to surface and edge defects to overcome
the problem. In order to reduce computing time, tile images from line camera and the FPGA embedded parallel image processing unit designed with VHDL were used.

Boukouvalas et al. [5] discussed that the ceramic tiles manufacturing process has been completely automated with the exception of the final stage of production concerned with visual inspection. The problem of automatic inspection of ceramic tiles using computer vision was considered. The detection of defects in textured surfaces was an important area of automatic industrial inspection that has been largely overlooked by the recent wave of research in machine vision applications. Initially, the benefits to the tile manufacturing industry were outlined. This was followed by a categorisation of typical tile defects. Next, a number of techniques recently developed to detect various kinds of defects in plain and textured tiles were reviewed. The techniques ranged from pin hole and crack detectors for plain tiles based on a set of separable line filters, through textured tile crack detector based on the Wigner distribution and a novel cojoint spatial-spatial frequency representation of texture, to a colour texture tile defect detection algorithm which looks for abnormalities both in chromatic and structural properties of textured tiles. The above automatic inspection procedures have been implemented and tested on a number of tiles using synthetic and real defects. The results suggested that the performance was adequate to provide a basis for a viable commercial visual inspection system.

Zenon S.A et al. [45] developed a support code for a marble tile inspection machine. Marble tiles running on a conveyor belt are captured with a linear CCD camera, and the images are being used for geometrical inspection within 300 msec, which is the available time until the tile reaches the selection mechanism right after the inspection chamber. Supporting algorithm should be fully functional, fast, foolproof, and should be easily modifiable to accommodate tiles of any size and coloring. Since the whole system would be fully automated and used by inexperienced personnel, the algorithm should self-
check for CCD array problems, such as burned pixels, dirt on the sensor itself or on the housing. The absence of marble tiles on the belt or totally misplaced tiles should also be accounted for and the users should be alerted. The algorithm also supports storage on a database of a cropped image of the tile in a predefined image size. The corners of the tile are detected using line intersection, which in turn are used to calculate the geometrical characteristics. The final tile cropping is being done using projective transformation to adjust rotation, misalignments and size uniformity in the created image tile database.

In many machine vision applications for automated inspection, the illumination design is crucial to the robustness and speed of the inspection process. Hence, there is a need to investigate and to experimentally evaluate new illumination designs and techniques. Robin Gruna et al. [39] proposed an illumination technique using a projector-camera system which provides inspection images that directly display differences in the reflectance between two scenes [19]. A comparison with image differencing for deviation detection shows that the proposed illumination technique is in many cases advantageous from a signal-to-noise point of view.

Velaga Sreerama Murthy et al. [54] proposed condition analysis of overhead power distribution system insulators using combined Support Vector Machine (SVM) and wavelet Multi-Resolution Analysis (MRA) seems to be promising for Distribution System Monitoring (DSM) automation to cope with the increasing system complexity. Though system well-being analysis for engineering applications has been used mostly for electric power system reliability studies, the same principle has been extended for assessing the condition of insulators in a distribution system based on the extent of their damage. Video surveillance with fixed cameras provide the required images of power lines along with insulators at regular intervals, and the same is sent to a control room using Remote Terminal Units (RTUs) for analysis. Not only the health of the insulators, but also the
sagging of the lines, breakage of both insulators and lines can be captured with such cameras. The most significant contribution of the paper is to compute the condition indices for overhead power distribution line insulators to overcome difficulties related to vehicular applications in video surveillance. The results contained in this paper validate the efficacy of the proposed methodology for wide-scale applications in overhead power Distribution System Monitoring (DSM) automation.

2.7 ROD QUALITY TESTING

Se Ho Choi et al. [42] presented a real-time defect detection algorithm for high-speed steel bar in coil. As the target speed was very high, the proposed algorithm should process quickly the large volumes of images for real-time processing. Therefore, defect detection algorithm should satisfy two conflicting requirements of reducing the processing time and improving the efficiency of defect detection. To enhance performance of detection, edge preserving method was suggested for noise reduction in target image. Finally, experimental results showed that the proposed algorithm guaranteed the condition of the real-time processing and accuracy of detection.

Taira et al. [49] said that special steel bars are worked secondly and thirdly by customers, and used in the critical safety components of automobiles, among other applications. So it is necessary to inspect and condition rolled bars accurately piece by piece before shipping, and it is very important to manufacture bars to maintain their traceability. To meet these needs, Muroran Works has directly linked rolling and finishing processes by utilizing an automatic bar buffer warehouse, and has automated surface inspection of bars and improved their detectability. These improvements have reduced the scratches by cutting the number of times the bars are handled, have advanced surface inspecting accuracy by automating manual inspection and have enhanced bar quality.