IOT Based Food Freshness Detection Using Deep Learning Techniques
(Link: https://www.irjweb.com/IOT%20Based%20Food%20Freshness%20Detection%20Using%20Deep%20Learning%20Techniques.pdf)

Summary
Since today's era is more concerned about food quality and obtaining the nutritious values from fresh fruits and vegetables, so the researchers of this paper has added some innovation to provide more accurate results in terms of food. They enclosed here Convolutional Neural Network (CNN) and Object Detection Algorithm YOLO for identifying spoiled areas on food skin. Moreover, they added some specifications including checking emitting gas level detection from rotten food and spilage level using Artificial Neural Network and taking the spoilage food identification to the next level.

Methodology
Some of the major methods that is being used are as follows:

- First of using IoT based 360° gyro camera, the pictures of different foods were taken.
- Then, at the same time MQ2 Gas Sensor and MQ135 Gas Sensor detected the emmited methane and ethane gas respectively from the food.
- Then image processing segmentation was completed using CNN ImageNet and YOLO architecture algorithm.
- After merging infos, the output is analyzed for better accuracy rate of rotten food detection using MobileNetV2, DenseNet121 and EfficientNetB2.

Components Used
The components used here are given below:

- Raspberry Pi Model B
- MQ2 Gas Sensor (for detecting methane)
- MQ135 Gas Sensor (for detecting ethane)
- MG90S
- SD Card
- ESP 8266
- 360° Gyro Camera
- Web camera

Findings
In this research, the authors could calculate the amount of methane and ethane emission from a food using gas sensors. Also using improved CNN and YOLO algorithm helped to accurately identify defective fruits and vegetables

Novelty
The novelty of this paper is the implementation of MQ2, MQ135 gas sensors for methane and ethane emission, and using Object Detection Algorithm YOLO identified the defective parts from images.

Algorithm Used
The algorithms used here are listed down below:

- ImageNet Convolutional Neural Network algorithm
- Object Detection Algorithm YOLO

Analysis
After training the machine over 350 times for banana and apple, they found the accuracy rate nearly 97.9%.

Research Gap
This research doesn't include any smartphone based image processing segment.

Problems Faced
While writing down the literature review of this paper, the steps are not clearly written in points.

Future Work
The future research can be done by integrating with smartphone based apps that can use such methods for detecting food spoilage.