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SMART FOOD TRACKER

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ABSTRACT

This paper explores the different technologies, systems used in food monitoring and food nutrients. This is done according to contamination and degradation level present in food quality because of variation in surrounding condition like temperature, humidity, light and also different factors like gas concentrations that is added in food for its long lasting freshness but effect human body adversely. A multi-sensory system is implemented to remove flaws from existing system and also a better use of IoT in food industries and product safety is implemented. The data is collected via sensors and the algorithm processed on micro-controllers is displayed on the screen or LCD for the user, with proper log file created with the integrated gui that is integrated with the bluetooth to send the real time sensor that to be transferred over a range. A informative website have also been created for the users to notify the limits and to alert the proper standard described for good food.

Keywords: *Food Monitoring, Contamination, Multi-sensory.*

I. INTRODUCTION

To ensure food safety it should be monitored at every stage of supply chain. It serves the purpose of preventive consumer health protection by maintaining the required standard needed in food whether in terms of ingredients, storage environment, preservatives etc. Different micro-controllers used in monitoring techniques that is used in various environmental conditions. With these techniques the contamination and degradation in food is reduced to maximum level as we are able to notify at every aspect of supply chain. Packaging involves radio identification tags which collects data from the food products i.e there color change if quality degrades, it also identifies and send the data related to change in temperature, humidity.

The performance and analysis of routine measurements, aimed at detecting changes in the nutritional or health status of the population, or changes in the performance of the food and nutrition system. Monitoring includes continuous measurement aimed at detecting progress toward a goal or target.

A. Problem statement

Today not just us but everybody in this world is getting effected by the food they consume, its not only about the junk food, but all the packed foods, vegetables, products we consume and use in our day to day life, as all of them do not offer quality their temperature, moisture, certain gas content
vary time by time. Various food items need a definite temperature, humidity, light. To ensure the food safety it should be monitored at every stage of supply chain.

It serves the purpose of preventive consumer health protection by maintaining the required standard needed in food whether in terms storage environment which effect their nutrition level. Monitoring is a big aspect in every scenario and when it comes to health it become important to focus upon what we eat. Today from the time food comes from farm i.e. food that is produced in agriculture farm till it supplied to storing unit, between this interval also several aspects has to be figured out for the surrounding condition that has to be given to has to stop microbiological growth of bacteria that harms the product to be used by human being at maximum level.

Due to degradation in food qualities human has to suffer from several diseases like and these illness effect human liver there day to day routines at highest level.

Since 1976, the Global Environment Monitoring System - Food Contamination Monitoring and Assessment Programme, commonly known as GEMS/Food, informs governments, the Codex Alimentarius Commission and other relevant institutions, as well as the public, on levels and trends of contaminants in food, their contribution to total human exposure, and significance with regard to public health and trade. WHO implements the program in cooperation with a network Collaborating Center's and recognized national institutions located all around the world[37].

Estimates of food and nutrient intakes defines by the proper standard of values that has been fixed by the food health organization so as to identify potential nutritional inadequacies and inappropriate food consumption patterns. This includes issues specific to the warehouse or cold storage monitoring where it has to be properly monitored at every step. Food and nutrition monitoring and surveillance involves continuous description of the components of the food and nutrition system for the purposes of planning, policy analysis, program evaluation and trend forecasting[34].

Fig 1 : Stages of monitoring system

It should monitor nutritional status and nutrition-related conditions. A monitoring strategy requires baseline data and regular data collection so that trends can be analyzed. It requires appropriate assessment and dissemination of information[2]. Information collected through monitoring and surveillance must be analyzed and transmitted to decision-makers in an appropriate format and in a timely fashion if it is to be of real value. It is critical that the information be accessible to those for whom it is intended and that mechanisms exist for evaluation and feedback on the information's usefulness for planning. Dissemination of information must be an interactive process[2],[33].

B. Goals of monitoring system

The primary goal of a food and nutrition monitoring and surveillance strategy is to provide the basis for a comprehensive food- and nutrition-related action program through the collection of relevant data that are regular, informative, coordinated, timely, reliable and effectively and efficiently disseminated. An important attribute of such a system is its predictability: decision makers need to be able to anticipate the range and timing of information and plan on that basis.

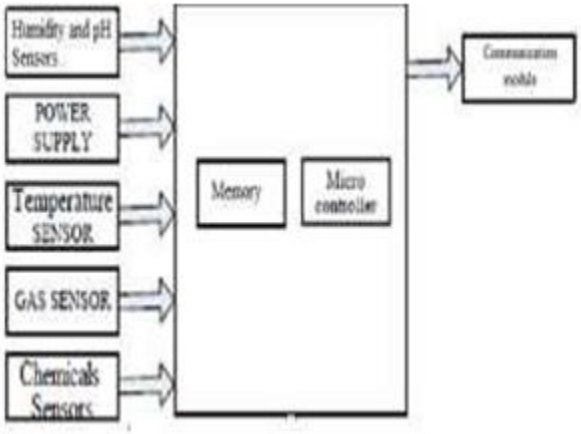

Fig 2 : System architecture of Smart food tracker

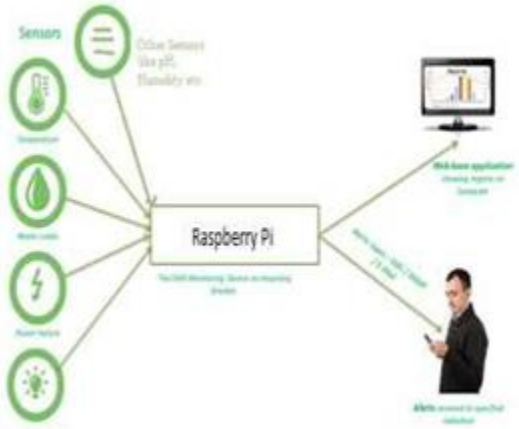

Fig 3: Food track architecture

Some of the examples tells us why we should use a smart food quality and safety system:

1) even the bottled water today we are drinking is not safe,we have high quality of different brands,which notify that they have used high quality technique to make the water alkaline but this is not whole true,they have this acid factor which is highly damageable to human body.
2) Raw fruits and vegetables are consumed in high amount get contaminated easily and lost their freshness if not put in standard environment condition.
3) Preservatives in high amount in the meat like carbon monoxide will lead health disease

Architecture showing the integration of internet of things in which we have sensor elements, processing and computing module which is sending alert to the user or the monitoring unit. Finally for our system, we are integrating Sensors Subsystem:

- Temperature and Humidity Sensor : SHT10 Light Intensity Sensor :TSL2561
- pH sensor : MSFET3330

Processor Subsystem:

- Raspberry pi 2 Board

We are designing a system to minimize this spoilage and preventing the food from being contaminated as much we can. We are using "Raspberry Pi 2 board". We are using different kinds of sensors to measure the surrounding effects on food and its storage conditions. After all this analysis of the board according to our need, and the type of sensors and ide needed for the designing of this appropriate system, we further do all the setup required with the suitable software platform and make this design work in real environment.

II. IMPLEMENTATION

We are doing implementation in two categories:
1) food monitoring with the surrounding condition(temperature, light, humidity)
2) food safety

Implementation according to surrounding conditions is done through temperature, humidity and light sensor. This light sensor and MQ series sensors we are integrated with ADC to get a proper value of luminous intensity and proper gas concentration in ppm. For the safety purpose of food that we are taking example meat, contains methane gas which has to be detected before a person cook it and eat it, this is for this we are using mq series sensor.

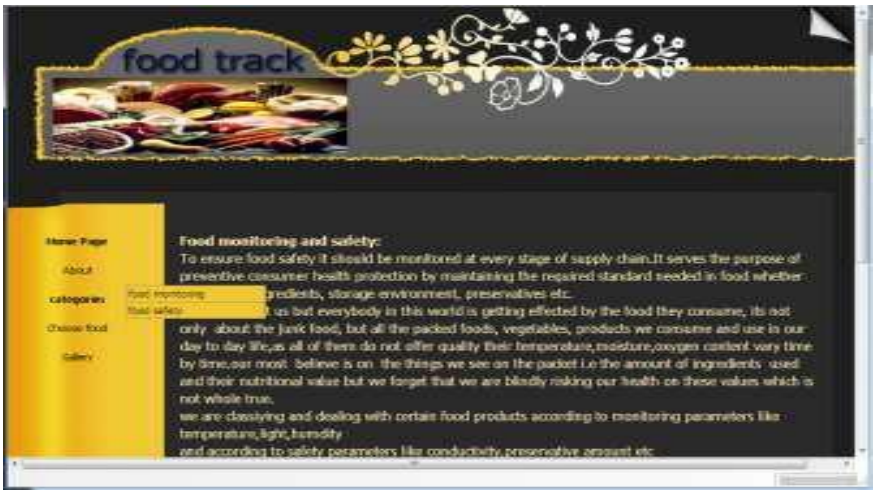

Fig 4 : Informative web page developed for users

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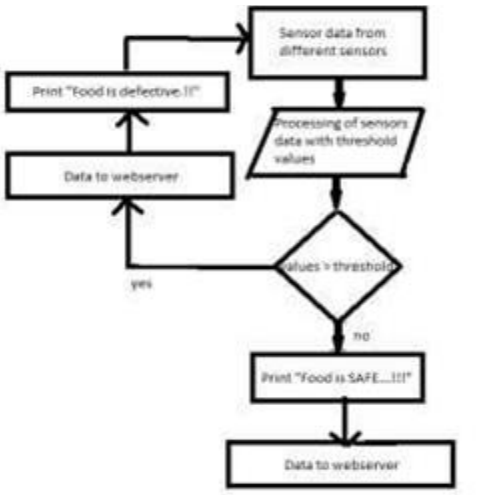

Fig 5 Workflow diagram

Fig 6 : GUI created for SMART FOOD TRACKER

A. Monitoring with surrounding condition:

a. Temperature, humidity**:**

For every 18°F rise intemperature within the moderate temperature range (50°F-100°F) where most food is handled, the rate of chemical reactions is approximately doubled. As a result, excessive temperatures will increase the rate of natural food enzyme reactions and the reactions of other food constituents.

- Protein will breakdown or denature.
- Emulsions will break – a product like mayonnaise will separate.

- Some vitamins will be destroyed.
- Moisture will be lost and foods will dry out.
- The color, flavor and odor of some products may be affected[26].

b. Light sensor: Almost all foods are exposed to lightfrom natural or artificial sources during processing, packaging, storage, shipping, and marketing. The exposure of foods to light can result in its deterioration (also known as photo-degradation). Photo-degradation usually occurs in specific food constituents, such as pigments, fats, proteins, and vitamins, resulting in discoloration, off-flavors, and vitamin loss[8],[21].

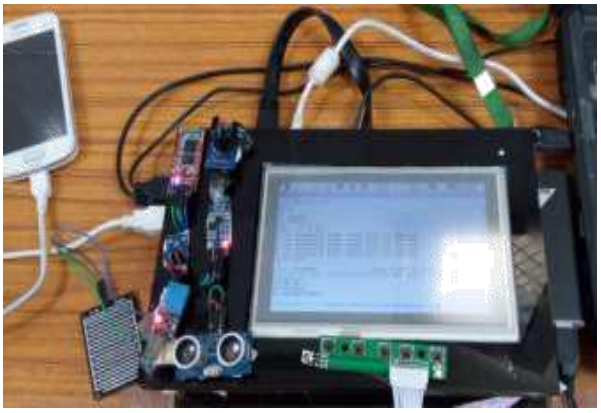

fig 7: Smart Food Tracker

Fig 8 : GUI where all the sensor values appear

When light strikes a package of food, several things happen. The light is: reflected off the surface of the package; absorbed by the packaging material; scattered and absorbed by the food; and transmitted through the food. Light induced changes in food usually begin in one of two ways:
1) Light is absorbed by a component in the product that will directly undergo chemical reaction
2) One component in a food causes some other component to undergo reaction because of light.

Deterioration can occur when light sensitive constituents, like those shown below, are exposed to light[6],[28],[31]. Nutrients that get effected due to improper monitoring conditions are: Vitamins -- Vitamin A, Vitamin B12, Vitamin D, Folic Acid, Vitamin K, Vitamin E, Pyridoxine, Riboflavin Pigments -- Anthocyanin, Carotenoids, Chlorophylls, Myoglobin, Hemoglobin Amino Acids -- Tryptophan, Phenylalanine, Tyrosine, Histidine

Fats -- Unsaturated fatty acids, Phospholipids

B. Food material we monitor are:
a. Milk. Increased interest in the nutritional quality of foods has led to concern about the packaging and handling of milk due to its light sensitivity. Milk is displayed in retail stores under high intensities of light that can cause considerable photo-degradation of milk constituents. This exposure can result in distinct flavor changes as well as the loss of added Vitamin A, Riboflavin and Vitamin C (ascorbic acid).

Milk packaged in polyethylene containers showed a 90% reduction in added Vitamin A after twenty-four hours of exposure to fluorescent light[32].

b. Meats. Fresh meats exposed to oxygen usually have a desirable, cherry red color. When exposed to visible light for long periods, the pigment at the surface of the meat slowly changes to a brownish gray color. Ultraviolet light causes a rapid fading of fresh meat color as well as accelerates the development of rancidity in the meat fat[22][23].

C. Food safety:

In food safety we are considering ultrasonic sensor, gas sensor i.e. MQ series sensors for the food safety, like here we have taken MQ13 air quality sensor all these we have for safety conditions.

Now according to the different needs and required food storage and testing conditions, we integrate our sensors with the board. We integrate our board with the pc/laptop and after detecting the OS from SD card our system boot up, and we start our programming in python. We interface our communication module and according to the conditions we have put, the alert message will get send to the supervising unit or the user through bluetooth .Secondly we are developing a log file for real time sensed values with a proper website that has been developed to tell the safety and proper limits for the specific food.

III. WORKING OF THE PROPOSED SYSTEM

- Proposed a system to minimize this spoilage and preventing the food from being contaminated as much we can.
- "Raspberry Pi 2 board" is used
- After all this analysis of the board according to the need, and the type of sensors and ide needed for the designing of this appropriate system, further all the setup required is done with the suitable software platform and make this design work in real environment.
- Different kinds of sensors to measure the surrounding effects on food and its storage conditions
- Biochemical and safety sensors like hall effect, gas sensor, ultrasonic sensor has been used.
- Web application for the overview information has been made.
- After integrating all the sensors with the pi we will do the calibration of sensors to make them more accurate.
- Sensor data is send wirelessly via bluetooth that would be accessed at every testing unit.
- A web application is designed to notify every information regarding the food products and defining the standard degined for food according to the preservatives and ingredients defined.

IV. CONCLUSION AND FUTURE WORK

The proposed systems in this paper mainly focus of preserving the food material by applying various techniques and analysis which includes monitoring and safety.

We will be taking care to use and design more sensors that could be integrated for the food industry for cold storage or warehouse with the small testing unit features so as to prevent damage to food products with proper monitoring analysis according to surrounding conditions to contamination and degradation. In future we will be taken care to implement for more dipping sensors with the graphs and plots to be used at the user or remote end with the proper integration of all the log files of data values taking from sensors and sent wirelessly over the server so as to be taken and used by another controlling or remote unit in a range or over the internet.

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