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Food Waste Management Using Machine Learning

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Abstract: With the increasing population and industrialization of nations throughout the globe, food waste has become a great concern for all of us. With the help of technology, Machine Learning based Food Waste Management solutions and initiatives that ensures reduced amount of time and energy required can be introduced to provide waste management services and reduce the amount of food waste generated. Different machine learning algorithms will be used to predict the food wastage and the best one will be chosen. Therefore, in this research thought on developing a Machine Learning based food waste management system for restaurants that will predict the daily consumption of food in the restaurant based on the previous data has been made. This will help the restaurant to either reduce or increase the quantity of food based on the prediction. Also a web application has been prepared through which donation the food to the charities or NGOs related to the food concern even if any food is wasted after the prediction can take place.

Index Terms - Food Waste Management, Prediction, Android, NGO, Donation, Restaurants.

1. Introduction -

Food waste or food loss is food that is not been served in restaurants. The causes of food waste occur at different stages of producing, processing, retailing and even consumption. Food Waste management is one of the core concerns of modern age. Many people waste a lots of food as they don't value food since they get it so easily .On the other hand, there are even people who don't get any food to eat for days. So, there is need to create concern about this. As nations around the world are developing, their concerns and accountability for a healthier and sustainable environment is also increasing. Waste are carried and thrown improperly leading to unhealthy and inhabitable environment that costs the government insane amount of money with not at all positive impact. In this research, we proposed to design and implement an effective food waste management system based on Machine Learning in perspective of developing countries using Linear Regression algorithm for smart decision-making systems and Decreasing Time algorithm for collection and sorting of waste. Optimizing distribution and storage in developing countries and enabling better consumer information in others could solve this problem. Another option can be to distribute food that is unused. Food can be donated to the charities or NGO's which will help the needy people. Food wastage is a massive problem and one of the most overlooked thing in today's world. Some restaurants/cafes have a policy to not serve food from previous day, despite being perfectly edible. This is all thrown away as "waste", at the end of day. So the application provides a way to bridge the gap between the wastage and deficit, by letting restaurants donate this food to NGOs, who in turn can feed the needy. According to the Environmental Protection Agency, food waste is now the primary kind of waste going into landfills, and 15% of the food waste in landfills comes from restaurants. This costs the food industry $8 billion to $20 billion annually, takes up a large amount of space in landfills, and contributes to the alarming rate of climate change. On the other side, there are many organizations find it difficult to provide food to those who need it while an alarming amount of viable food is wasted daily by restaurants. In today's date, almost everyone has an android phone. So this android application will help them a lot through food delivery. Food wastage has become an extremely tough issue in today's date. NGOs can contact food donors for food items so that poor people can at least attend two meals per day. The application has a very user-friendly interface so everyone can use it efficiently. Using prediction algorithms, it can be predicted that how much food is wasted on the respective days of a week. So only that much amount of food can be prepared. In case if extra food is produced, it can be notified to all the nearby NGOs. So using a third party vendor, the delivery of food items from donor to the receiver can be executed. So using this application, the problems of food wastage can be reduced to such an extent that everyone gets two-meals per day. In this way, we can at least try to be a good cause for our society. We need to try to reduce this problem before it leads to a larger death scale due to hunger. Food waste had led to lot of costs in the economic and other sectors as well which has led to efforts in public and private sectors to reduce food wastage along the supply chain. Efforts to address food loss need to be implemented to address food waste as well.

2. LITERATURE REVIEW -

1) Food Donation Portal

In year 2017, Naman Talati et.al. [1] through their research paper explained that the donation of food that continues to be edible will be seen as a selected application of urban mining as food is recovered for its original purpose – human intake. There are many projects enforced worldwide however owing to an absence of information, scientific literature concerning of food donation activities offers a medium that connects donors with NGOs. An idea for a food donation network is presented and impact on society through this medium is mentioned. The problem of food wastage has been increasing a lot from the past few years. In order to minimize the problem of food wastage, this research has been conducted. In this paper, we get to know about a food donation portal. This portal connects two groups of people; one group having excess of food and the other group which needs food items. The application has been developed through which people can donate food items as per their capacity and it also allows organizations to put up their requests that is items required by them, if any. If any institute wants to donate something, it can send a message in application. This message will be shown as notifications in donations tab to other users (NGOs). Once a message is sent, the orphanages who wish to claim the donations can reply to the donor and contact him/her. In this way, this portal can help in reducing a lot of problems related to food wastage. The advantages were that there was reduction in the food waste and there was fast and efficient delivery of the food. It would help thousands of people that suffer from starvation. For proper tracking of destination, it would require a continuous connection.

2) Beyond Food Sharing: Supporting Food Waste Reduction with ICTs

In year 2016 ,Aaron Ciaghi et.al.[2] through their research paper explained that even if there are many charity organizations, lots of food is been wasted. Nearly 280-300 kg per person per year is wasted in Europe/NA. The food is important energy demanding product group and resource. Food wastage decreases a country's economy to an extent that most of us are unaware. If food is wasted, there is so much waste of water used in agriculture, manpower and electricity lost in food processing industries that we can't even think of it. This examines and results the availability and effectiveness of existing ICTbased tools and smart technologies for food management and waste reduction by consumers. It results that consumers are interested in apps that help in reducing food waste.Hence, we have taken care of that. This paper consists of innovative ideas and technologies for food waste management. Degree of recoverability for different type of food waste is been found and different results are found out. They have offered tools that measure food waste. They have prepared website that connects food donors with charities. Different charities use this to reduce wastage of food.

3) Food Wastage Reduction through Donation using Modern Technological Approach: Helping Hands

In 2016, Komal Mandal et.al. [3] through their research paper explained that India is a country where the economic status has reached a high level that tons of available edible food is thrown away as waste in every stage in marketing. The food waste is approximates 25% of the amount of edible food. The prevention of food waste can be done by contributing to save resources as well as to reduce environmental impact during all stages of marketing system. Nobody intends to waste food in the beginning, some situations in marketing behavior and individual lead to food waste. Food wastage is an issue which needs to be reduced to an extent to which everyone should be able to attend at two meals a day. In this paper, we get to know about an internet-based Android Application which helps in solving this issue. Organizations can register in the system and then put up their item requirements. Seekers can view the list of items put up by donors and if required, can claim the donated item by contacting the donor. However, the application is limited Android Smart phones with Gingerbread OS and higher versions. Also, the application will be beneficial if donors and seekers are located near each other. The application has 3 actors: - Donor, Receiver and Admin. The donor can view Receiver's location and receiver can view donor's location since it is necessary for the delivery. The main objective of the proposed application is to reduce the wastage of food and make food available to old age homes, orphanages and other such organizations. It saves lots of time and even the death rate due to hunger is reduced. The only problem caused then was that the application would only run on android devices greater than 2.3.7 which now is not the concern.

4) A Methodology for Sustainable Management of Food Waste

In year 2016, Elliot Woolley et.al. through their research paper explained that the decision as to which is the most beneficial waste management alternative to utilise to manage food waste is usually made considering fundamentally only economic reasons and availability of waste management facilities. Furthermore, legislation delimits the range of solutions applicable to manage different types of food waste and therefore the decision is often made considering only a few alternatives. This paper seeks to add environmental and social considerations to the decision-making process so that more sustainable solutions can be achieved from the range of feasible waste management options. With this aim, the structure of the research presented in this paper is as follows: firstly, the definition of food waste used throughout this paper is provided; secondly, previous categorizations of food waste are discussed; thirdly, a categorization process is described based on the most pertinent indicators to classify food wastes; fourthly, the different types of food waste identified are linked to their most appropriate waste management alternatives, building a Food Waste Management Decision Tree; and finally, the categorization process is illustrated with two case studies from the UK food industry.

5) Friendly Waste Segregation using Deep Learning

In year 2016, S.Sudha et.al. [5] through their research paper explained that in India, garbage disposal system is done manually for segregation of waste. This may even cause different diseases and is unhealthy. So the objective of this paper is to bring an automated process for waste segregation. This idea focuses on identification and classification of waste that is dumped in garbage. Images will be collected with the help of camera. They will be analyzed and trained. Object Identification will take place. Prediction will be based on identification and Probability index. Object is then classified as biodegradable. Implementation is done using Caffe-Framework. The project acts as an aid for reducing population levels and development of nation and restoration of ecosystem. The advantageous point was that it classifies object into bio-degradable and non-biodegradable and also decreases pollution to some extent. The negative point is that it is risky in case of improper operations.

6) Predicting Sales in Food Store Department using Machine Learning

In year 2017, Robert Siwerz et.al. [4] in their research paper explained that prediction of sales is important in food industry as it increases business and profits. Machine Learning has been used for predicting sales in the food store. It takes old data, studies patterns and predicts outcome. Three different Machine Learning methods are used in this paper: - Multilayer Perception (MLP), Support Vector Machine (SVM) and Radial Basis Function Network. The features they used are Day in a year, Day in a Month, Day in a Week, Holiday and Dept. Price and the label used is Amount of sales. Two different predicting measures are used: - Mean Average Percentage Error. It was found out that SVM recorded lower average MAPE and RMSE than other two methods. SVM is most accurate for predicting sales in format. It was found that prediction of sales result in improvement of business operations and profits. The disadvantage was that the result was not informative if sufficient data was not given.

3. Methodology -

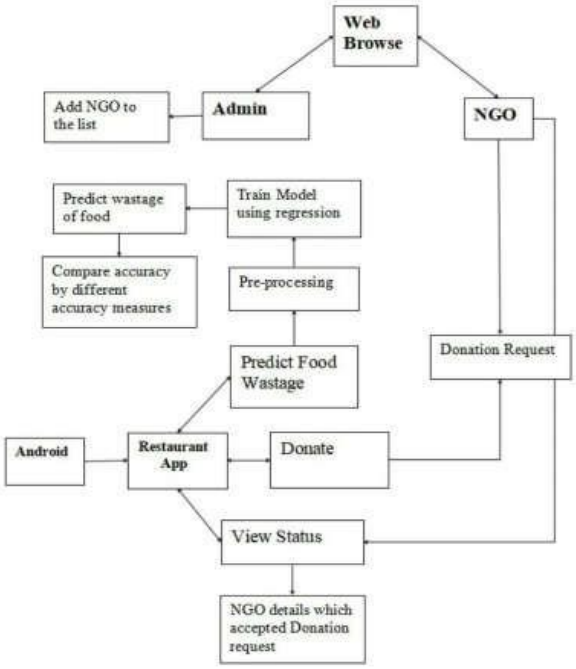

Figure 1. Block Diagram Register:

This is the page where a person can register in our application. Credentials like Name, Contact Number, Address, E-mail and password are required. By entering these credentials, he/she can make an account in our application. Once the account is created, the location of the restaurant will be stored.

Login:

This is the login page of our android application. A user can enter his credentials i.e. e-mail and password and log into the application. If a person doesn't have an account in our application yet, then he/she can register as well.

Donate:

This android application will be used by the restaurants. After login, they can put up a donation request by mentioning the description and the quantity of food available. This request will be sent to the browser side by our application.

Prediction:

We have used a linear regression model. Data is collected from restaurants where the data is about how much food is prepared and gets wasted. Linear regression algorithm will be applied on the data and and then we can predict how much food needs to be prepared in order to prevent food wastage.

Browser:

Now comes our website. There are two users for our website. One is the user and other is the admin.

NGO (User):
Users will be directed to the homepage when he/she logins or registers into the website. He/she can see the request list in order to see which restaurants have sent a food donation request. The restaurants list will be arranged in such an order that the restaurants which are close to the NGOs will be displayed first accordingly. The NGOs can accept any request as per their location and needs. Once a request is accepted, it gets removed from the request list.

Admin:
The admin can access the NGO list. He can add NGOs to our website. The user cannot access the NGO list. On the NGO list page, the list of NGOs we are associated with, are presented. Attributes such as Name, Address, Contact number and e-mail are shown. This page is not available for the users. This is only accessible to the admin. The reason for this is that the admin can ensure the absence of fake NGOs in this website. He/she can take notice that only the trustworthy NGOs are informed about the food sharing. Once an NGO gets added to our website, an e-mail and password is sent to the NGO using which it can login to our website.

View Status:
The restaurant can view the status of their donation request by selecting the View Status section in our application. If any NGO has selected their request, then it will be visible to the restaurant. Details of the NGO like Name, Contact, Address, Email, Quantity of food and the type of food (e.g. Rice) will be displayed. He/she can also view the location of that NGO using Maps. When the NGOs accepts a request, it is updated to the restaurant through the application. After that, the restaurant can just contact the NGOs and do the procedure of delivery of the food.

4. RESULTS -

Figure 1. App Homepage

Once the Signup and Login is done, this will be the homepage for users(restaurant).So Restaurants have three options, they can either donate food or view their donation status either if it is accepted by any NGO's or not or they can let us do prediction on their data.

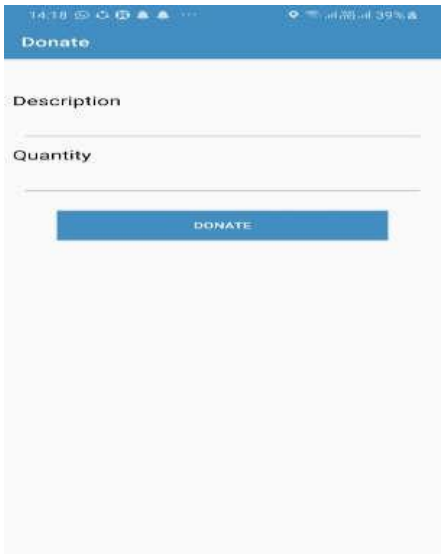

Figure 2. Restaurant Donation

In Donate, restaurants can provide description about the food they are donating and quantity of food that they are donating.

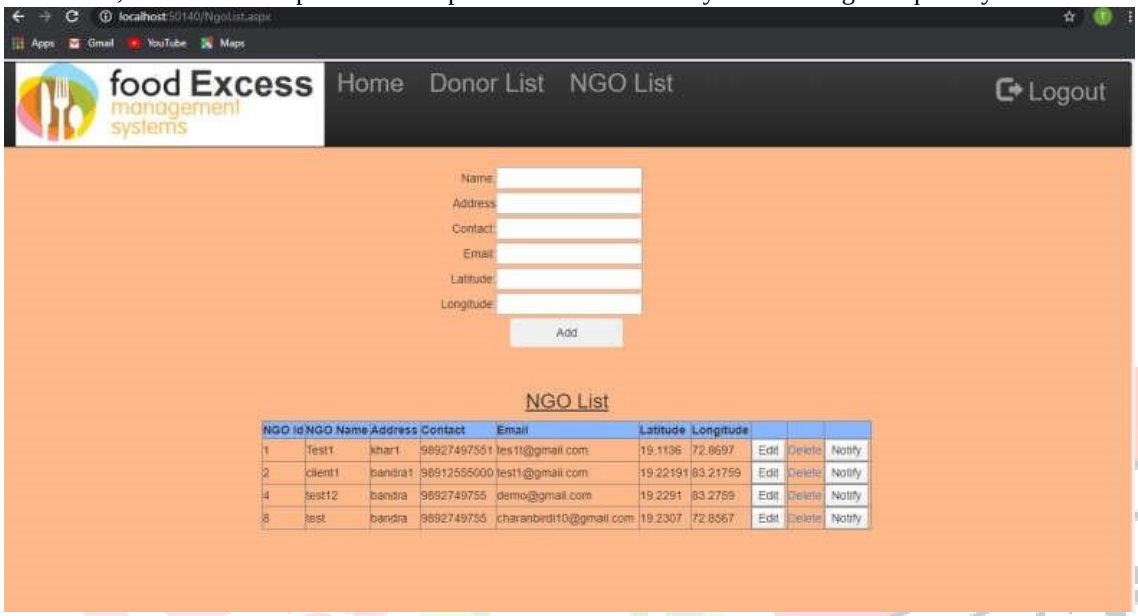

Figure 3. NGO List

This is NGO list and is accessible only to the admin because only admin can add the NGOs to the list.Admin can even notify to the NGOs about food donations done by restaurants.

Figure 4. Donation Request

Once the donation is done by restaurants,NGOs can check the donation requests on view request tab and decide if they want to accept the request or not. Once the request is accepted, the donation is removed from the list so that no other NGO accepts it.

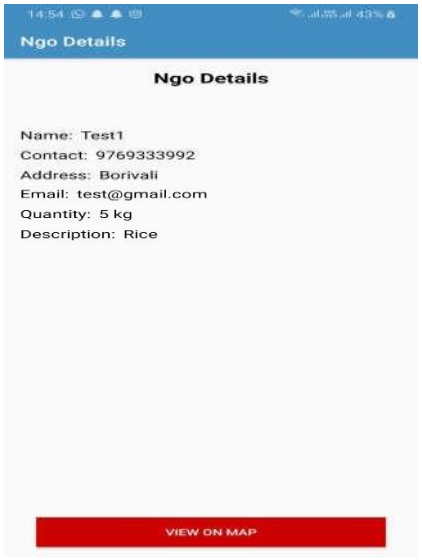

Figure 5. NGO Details

Restaurants can see their donation status through view status option. If any NGO accepts their request, all the details about NGO will be made available to the restaurant and can also see the location through maps.

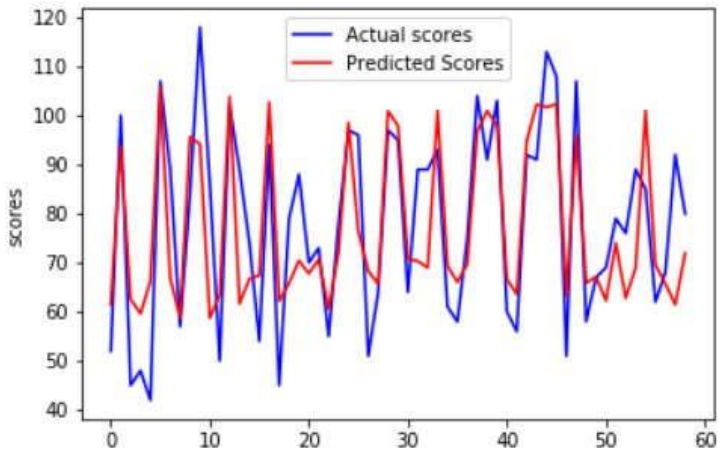

Figure 6. Prediction Results

Here, from the above figure we can see that nearly 85kgs of food is been prepared daily by the restaurant and it is predicted to prepare nearly 70kgs of food so that there can be less wastage of food.

5. Conclusion and Future Work -

In this proposed system, we have developed a system for donating the excessive food to the needy or NGO's .Food Waste Management has been designed in such a way that it can fulfill the needs to help reduce the wastage of the food that is been happening and even donating the food that is not been served to the customers to the charity or NGO's.Even prediction is done on how much food the restaurants should prepare in order to avoid the wastage of food and save them the resources. Restaurants can donate their food to the nearest NGO's in case the food is prepared in excess. All the NGO's will receive the donation request and can decide if they need to accept the request or not. Since the prediction is done separately, in future we can add prediction in Android App and it can be automated .Even Geo-location can be used for finding the nearest NGO and track the nearest path.

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