

Smart Food Wastage Management System in IoT with Effective Alerts using MQTT Protocol

S. Sharmitha, P Karthikeyan

Abstract: The paper focuses on developing a system for avoiding food wastage to automatically manage wastage using IOT. Smart food wastage management system is used to organize and distribute food without wastage. According to research done major part of food wastages are done in the events, approximately 1.3 billion-tons of food produced for human utilization is lost or squandered universally. To provide a solution, this system manages wastage of food at all events by estimating the quantity of food needed for the expected people accurately. In the present scenario the caterers fix the quantity approximately for the people expected manually. But this system allows caterers to predict accurate quantity of food needed for the people automatically using sensors. This system also helps to donate food through established contact details of NGO's synced. It sends them notification if there is excess food available at the event. The alert message is notified through the application. It also provides smart refilling system at the buffet. Using level sensors, level fixing is done in the container wherein as the level drops down below the fixed scale, it will alert the caterers to refill the item in the particular container. Since estimation of food is done, we prepare accurately for the need. As the events proceeds it helps us to check on the quantity that is required as the serving quantity drops below certain level, it will alert the caterers to prepare the food that is needed. This will avoid prepared food wastage. Using this alert system, we make food only if needed on timely basis. The existing system will just predict on how much food gets wasted based on waste bin management and recycling the wasted food. In large gatherings there are chances of food being prepared, wasted and then recycled which can be intervened and stopped if we use our application as a preventive measure. In our proposed system we provide a solution for food wastage like estimation of accurately needed food than approximately preparing the food without measuring the exact need. Everything is notified using effective alert system of MQTT protocol.

Keyword: Message Queuing Telemetry Transport Protocol - MQTT protocol, IOT-Internet of things, Food wastage management system, NGO, Estimating the quantity of food, Smart refilling system, Donate food, level fixing.

I. INTRODUCTION

A. Background study

On a large-scale food has been wasted maximally around one third of the prepared quantity, which is economically not feasible.

Manuscript received on 15 November 2021 | Revised Manuscript received on 25 November 2021 | Manuscript Accepted on 15 December 2021 | Manuscript published on 30 December 2021.

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To minimize wastage and seek profit this application could be incorporated.

B. Problem statement

In our current skeptical view of food wastage management system, the preliminary basics like production, management and distribution is manual consuming more manpower and problems. There are no preventive measures or accuracy in quantities prepared or any automated check which is the great blunder of its efficiency.

C. Motivation

Computers have improved the accuracy, speed and reliability of many of the technical tasks traditionally involved regular checking of the quantity besides the services offered to users. This automated system is comprised of all the components that retrieve and transfer the data. It usually includes hardware, software, people, storage and the data. The activities involved include retrieving data, data transmit, storage of data, generation of alerts.

Since everything is being digitalized in today's world, it is effective to incorporate digital technology in food wastage management system for maximum prevention of wastage economically using sensors in internet of things (IOT). As the system is automated tasks are done more accurately, conservatively and reliably.

D. Existing System

Many applications that exists for food wastage management provide features to do recycling the food waste and measuring the food waste from bins. The existing system does not provide any automated technique for effectively measuring the food need and its preventive measures. Manual estimation of food needed is approximately done rather than estimating it accurately. Since it is manual and not automated, it is time consuming to manage food deterrence.

E. Disadvantages of Existing System

The systems that have been in use face the existing problems in the conventional way of manually estimating the quantity needed for the expected people at the events approximately that leads to wastage. Prepared food wastage is high, when there is an option of preparing food based on the need on timely basis. Lack of accurate information storage, prompt updating and effective alert system is another disadvantage.



F. Objective

The main objective of this system is to automate the task of minimizing the food wastage. This can be done by estimating the accurate quantity of food needed for the people expected at the events. The system records the quantity of the items using load sensor for the accurate estimation of food needed at the event.

Each time the sensor updates us for the number of people that can be served in the present quantity. The system measures the quantity level of each container using Ultrasonic Sensor for easy refilling at buffets without any interval. To refill, it also notifies through alerts for those that require and also generates how many people could eat in the available quantity via application, as to know if the extra food needs to be prepared. The goal is to make this system user-friendly, faster and accurate thus making it reliable. This system can reduce a lot of manual workload.

G. Proposed System

The application automates the food waste management and keeps track of the quantity of items. The system records with the help of ultrasonic sensor for measuring quantity level and load sensor to measure quantity load. If the level is low, the user is notified via Android Application.

Also, it estimates the quantity of item's needed for the expected number of persons, and also provide the number of people that can be served in that quantity.

This system provides us to make the required quantity of food needed on timely basis, depending on needs and also notifies to prepare for the food that might be needed and alerts when the quantity level lowers the fixed scale, by avoiding prepared food wastage.

And the system also allows the user to fix the level for each item of containers, and notifies if the quantity lowers the marked scale.

And if quantity is more, and when time exceeds the events closing time, then it will automatically ask for donation.

The application is divided into various modules whose descriptions are provided below.

II. RELATED WORK

Smart grocery system was made using Arduino board (Intel Edison). Here HC-SR04 Ultrasonic device sensor is used for level estimation which gives the flag of low measurement to the board. Temperature device sensor is used to measure the moisture in the compartment. And, messages are sending by MQTT protocol for communication to the network cloud [1].

The essential subject of the work is to develop a smart garbage alert system for a suitable waste administration. This paper proposes a smart alert system for garbage clearance by giving an alarm banner to the city web server for minute cleaning of trashbin with authentic affirmation subject to dimension of trash filling. This methodology is supported by the ultrasonic sensor which is interfaced with Arduino-UNO to check the dimension of garbage filled in the dustbin besides, sends the notification to the city web server once if trash is filled. [2]. A good and reasonable remote sensor organize is executed. Filling in as a benefit for research in the food business, this usage can be utilized

to watch the food utilization designs. Utilizing this prototype as a base, constant applications can be created to deal with our present stock proficiently with its implications in food and e-commerce industry [3].

This paper proposes an IoT based framework modified for Kitchen suffering from wasting food during cooking it as a result of a substantial number of meals getting ready in the meantime with the goal that the Chef can overlook them on the Cooker amid setting up another. This paper purposes the plan and usage of an (IOT) Internet of Things sensor organize innovation for refining food waste supervision and management [4].

Wastage management using Internet of Things (IoT), Waste minimization is that the strategy of treating strong wastes and offers sensibly answers for utilization things that don't have a place with trash. It's with respect to yet trash bin be utilized as a significant asset.

We find that there are proposed measures for waste management but no clear steps for prevention of wastage of food. Here we have implemented IOT techniques to enhance the system thus giving efficient results [5].

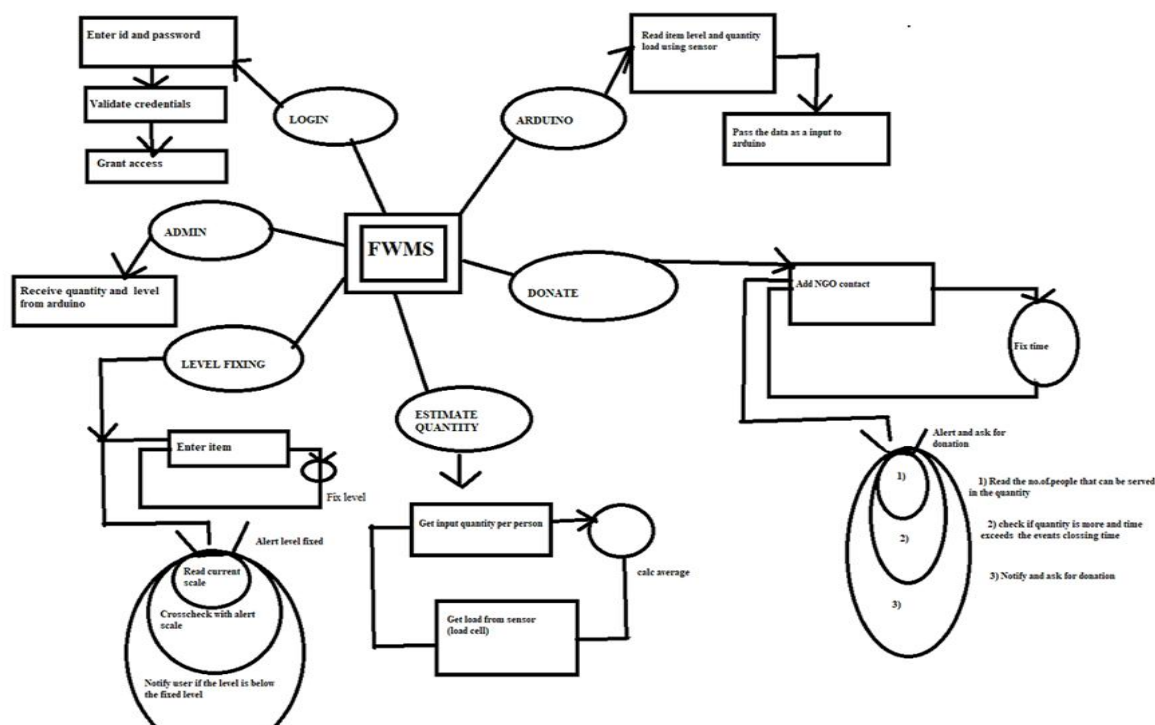
IOT based grocery management system, herein we understand there is a necessity to properly manage food and wastage in grocery management system. The use of IOT here initiates us to use this in our system of management and enables us to economically prevent lot of food waste [6]. Smart food monitoring is a unit which regulates order over various parameters causing decay or ruining of sustenance materials, accordingly guaranteeing proper nature of sustenance amid different environmental changes. This unit in like manner keeps the customer advised about the quality and the sum changes in the unit using the Internet of things advancement. [7]. Two-View 3D Reconstruction for Food Volume Estimation, herein we see that the food estimation could be done using automatic techniques in our system. our system ensures accuracy and prevents wastage, when prepared in exact levels [8]. Daily Diet Monitoring using the concept of Food Recognition and Leftover Estimation, here we propose a structure for automated dietary observing of canteen customers subject to computerized vision systems. The proposed system perceives food and estimates food scraps [9]. This examination proposes the utilization of MQTT protocol as a communication protocol, which is one of information communication protocol for IOT. Information procurement was done constantly and set away in the MySQL database. This examination is also wrapped up by interface mobile and portable for web-based observing. This result of this investigation is the redesign of information quality and reliability utilizing using MQTT messaging protocol. [10].

Food wastage reduction through donation, the wastage of food here is to be prevented and donating food is being initiated. This attribute can be enhanced by sending messages to various organizations thus the food reaching without being wasted through our newly developing idea of an application.

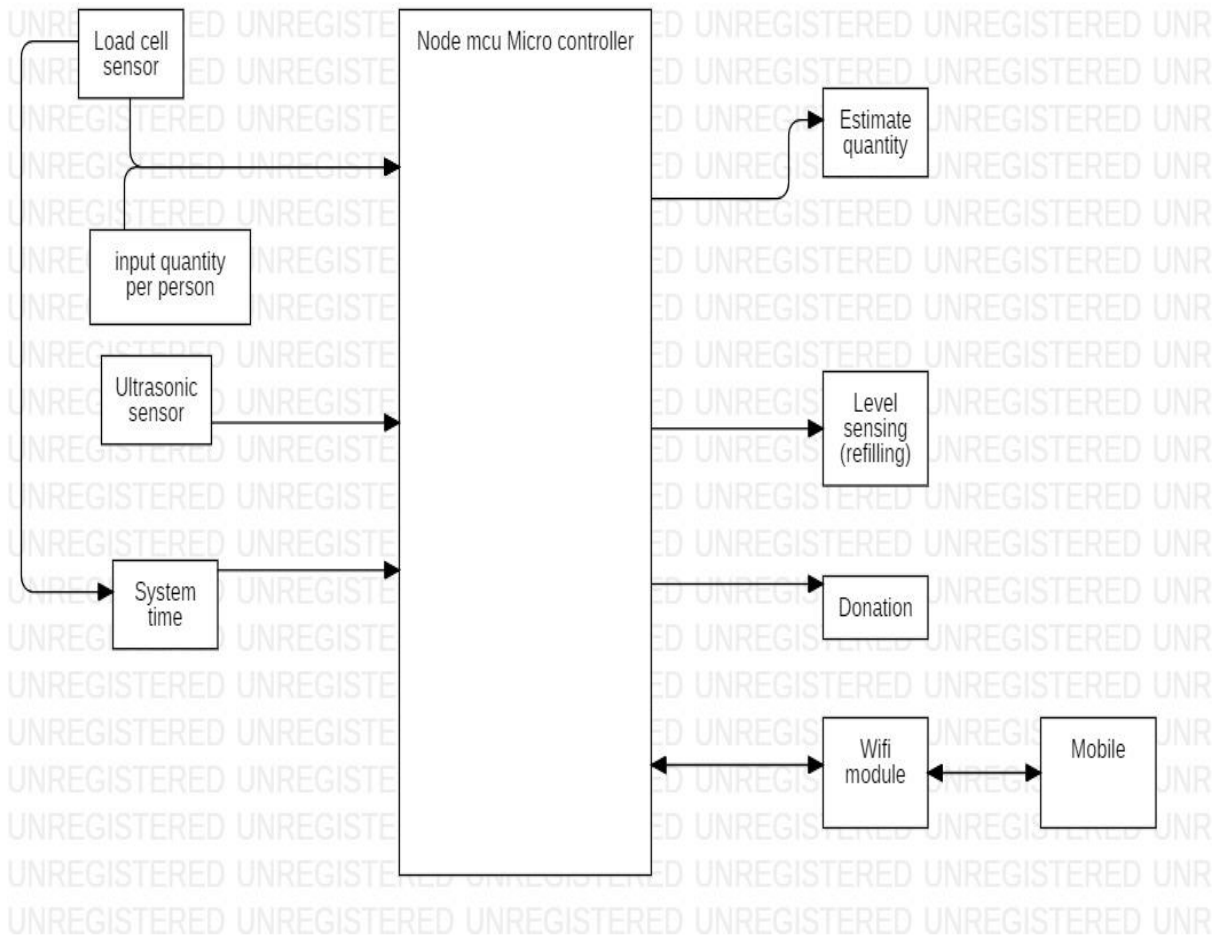
Results accomplished on 1000 clients of a genuine canteen are promising Automatic food acknowledgment is a basic endeavour to help the customer in his every day dietary observing. Nowadays, advancement can reinforce the customers in keep tracks of their food usage in a less demanding to utilize way considering an increasingly far reaching each day dietary observing. Progressing findings showed that computer vision strategies can help to automatically see food and measure its amount. [11]. The proposed framework is giving component of IoT Based smart System associated through Wireless module to a centralized server. A Raspberry pi will be utilized as central server. Programming interface is utilized for getting live train status for keen clock. Smart fridge uses pressure and temperature sensor for gathering data and communicate utilizing free web services. This entirety framework can be constrained by an internet browser. This framework grasps the functions of appliance monitor, control and management, home security [12]. Applying IOT progressions to smart home framework is exhibited. A unique design of the planned framework is analyzed with its point by point introduction. This structure has unbelievable adaptability. In perspective on this proposed structure various applications can be joined into the framework through uniform interfaces. Agents are meant to communicate with devices through RFID-labels. [13]. Stock administration, support and management are a vital device in any business. The tools that the management use in its administration is of significant importance to get a handle on once to put request for a brand-new item and refresh current standing can rely on how logical control is taken care of.

This paper encourage gives such devices furthermore, helpful in the executives, management and effectiveness [14]. Execution and Comparison of M2M Protocols for IOT, the spine of Internet of Things (IOT) is the communication protocol which flawlessly coordinate a great many hubs and empower a light weight information exchange process. Upon research on the present IoT improvement, the real conventions that fit IOT condition are COAP and MQTT. These conventions are light burden the extent that task and information move from now on make into the business sectors of IOT. The utilization of MQTT protocol in the IOT framework it is exceptionally proficient and gives us quicker alarms and updates. [15]. The proposed technique says that in the event that we can interface the various phases, so that these NGO's can get the "food to be wasted" without issue, and the eateries, party gatherings discover these food searchers with no additional exertion then it will serve a more prominent reason and will be a major administration to humans. Utilizing the forefront technologies, we can conquer any hindrance. Presently, Smartphones are accessible at a very moderate cost and are the most ideal approach to keep individuals and agencies associated. [16]. This paper proposes a framework that can handle this issue, utilizing the design of IOT (Internet of Things) and joining numerous automated sensors, for example, Ultrasonic sensor, Load sensor, Infrared sensor to monitor every households' food product. The yield of the machine is information that will be seen on client's phone, so as to help client's monitor the measure of food left on their capacity. [17].

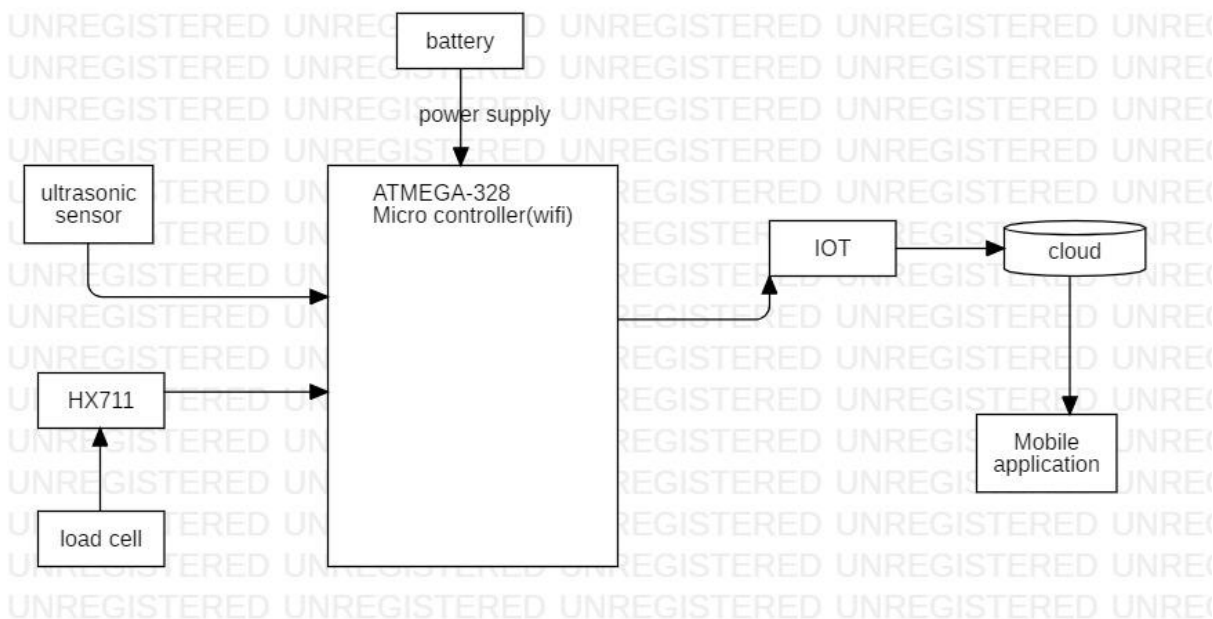
III. SYSTEM ARCHITECTURE DIAGRAM



3.4.6. BLOCK DIAGRAM-1



IV. BLOCK DIAGRAM-2



V. CONCEPT

A. Internet of things

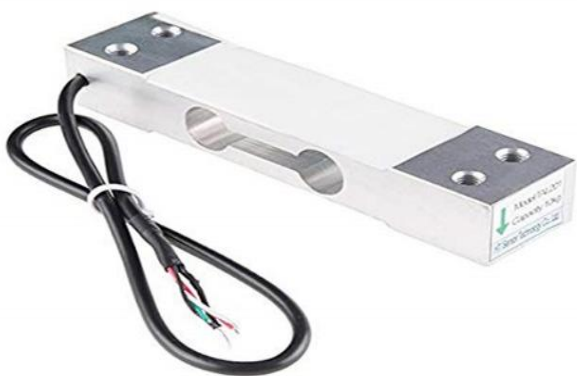
The interconnection by means of the Internet of computing devices inserted in regular objects, empowering them to send and get information.

B. MQTT Protocol

MQTT is the most regularly utilized protocol in IoT ventures. It represents Message Queuing Telemetry Transport. Also, it is planned as a lightweight messaging protocol that utilizes publish/subscribe operations to exchange data between clients and the server.

C. Estimate quality

Estimation is done by providing the input quantity of an item to be served per person and the expected number of people at the event will be given. It will display the accurate amount of item that will be needed for the expected people at the event. It also updates every time about the number people that can be served in the present quantity. The quantity is measured using load cell.



Load cell

D. Level Fixing

This allows the user to flexibly fix the notification scale for the distance between the Ultrasonic Sensor and the stock level. Due to the existence of varying needs and usage and differing container sizes, the user can manually alter the scale for each and every item.



HC-SR04-Ultrasonic Sensor

E. Refilling

In smart refilling system at the buffet, using level sensor, level fixing is done in the container wherein as the level drops down below the fixed scale, it will alert the caterers to refill the item in that particular container.

F. Checklist

The notified items that needs to be refilled are added to the list.

G. Donation

The system also helps to donate food through established contact details of NGO's synced in the application. It sends them notification if there is excess food available at the event, when time exceeds the event's closing time. The alert message is notified through the application. For effective alert system MQTT Protocol is used.

VI. IMPLEMENTATION

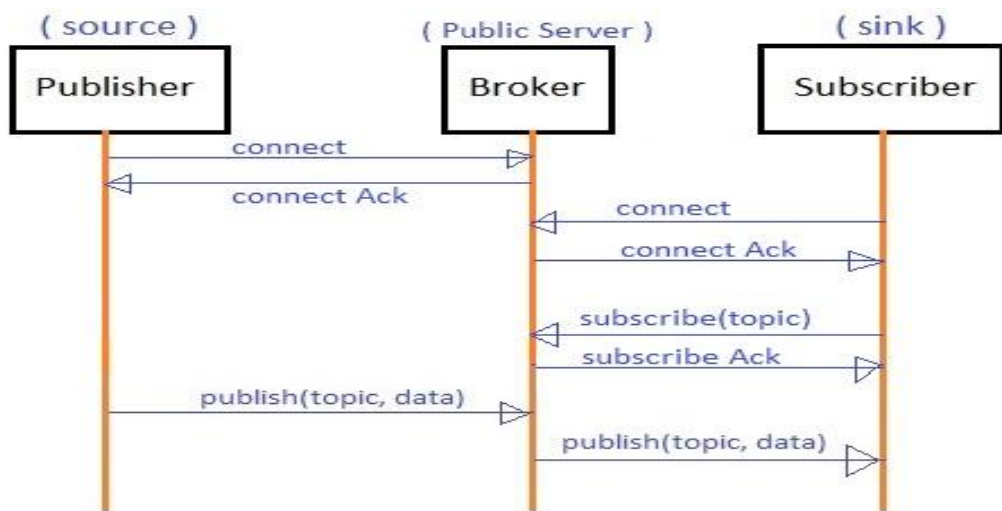
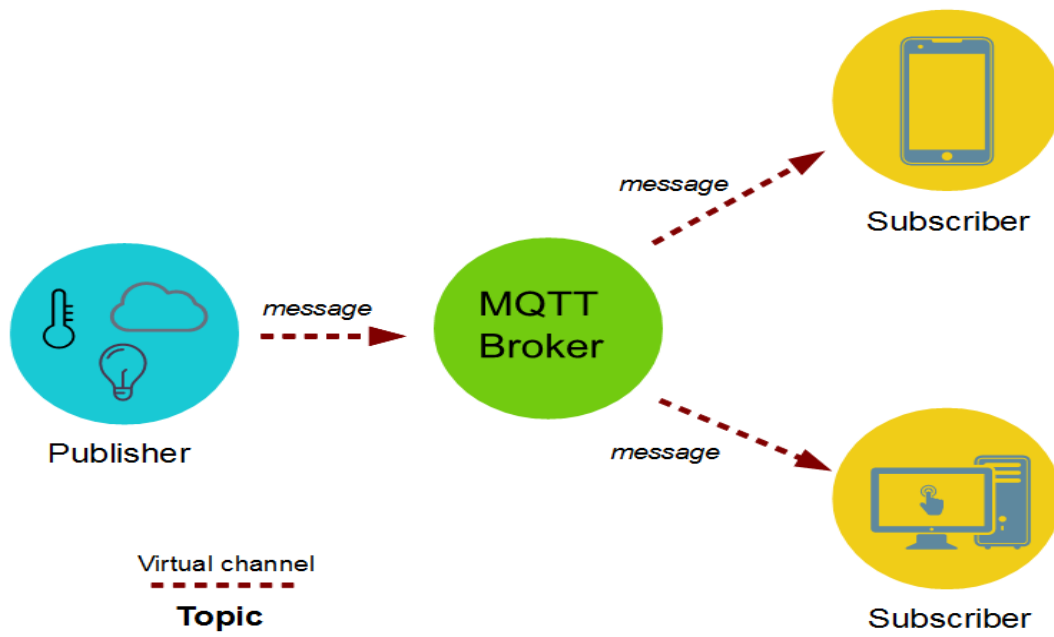
IMPLEMENTATION DETAILS

1. Create an account and interface in Mosquito or eclipse Mqtt cloud interface.
2. Develop the code in ARDUINO ide also add the node MCU board in ARDUINO ide with the required library.
3. Use the server Id, port number and topic in the required field.
4. Connect the ultrasonic and load cell in node MCU pins as declared in the code.
5. Give the WIFI ssid and password through which you are going to connect to the Mqtt cloud.
6. Establish the connection with the cloud and use the same credentials in the app and Mqtt box for the interface.
7. After establishing the connection open the serial monitor in ARDUINO for status.
8. Assuming each person will have 200 grams food, and the refilling level as 15 cms.
9. The corresponding data will be shown in the app and Mqtt box.
10. Finally the user can donate the food by triggering the donate module. The same will be notified in the app and Mqtt box.

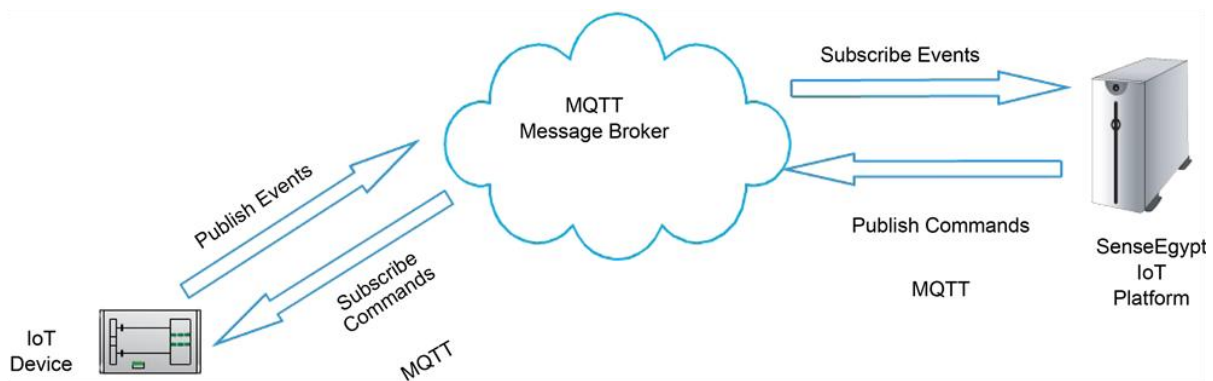
VII. METHODOLOGY

MQTT Protocol

MQTT is the most regularly utilized protocol in IoT ventures. It represents Message Queuing Telemetry Transport. Also, it is planned as a lightweight messaging protocol that utilizes publish/subscribe operations to exchange data between clients and the server.



Broker based MQTT Protocol



VIII. SAMPLE SCENARIO

This particular system can be used at the large gathering events to manage food wastage effectively. The detailed use of each module in the system is explained below. Smart food wastage management system is utilized to arrange and distribute food without wastage. As indicated by research done significant piece of food wastages are done in the occasions, around 1.3 billion tons of food delivered for human utilization is lost or squandered all inclusive. To give an answer, this system oversees wastage of food at all occasions by estimating the quantity of food required for the normal individuals precisely. In the present situation the food providers fix the quantity around for the general population expected physically. In any case, this system enables us to take into account anticipate exact quantity of food required for the general population consequently utilizing sensors. This system additionally donates food through set up contact subtleties of NGO's synchronized. It sends them notice if there is abundance food accessible at the occasion. The alarm message is notified through the application. It likewise gives smart refilling system at the buffets. Utilizing level sensors, level fixing is done in the compartment wherein as the level drops down beneath the fixed scale, it will caution the food providers to refill the thing in the specific holder. Since estimation of food is done, we get ready precisely for the need. As the occasion continue it cause us to mind the quantity that is required as the serving quantity dips under certain level, it will caution the cooks to set up the food that is required. This will dodge prepared food wastage. Utilizing this ready system, we make food just if necessary, on convenient premise.

IX. CONCLUSION

The objective of the paper is to provide an automate the food wastage management system, the preliminary basics like production, management and distribution in a automate way. The system creates a preventive measures and accuracy in quantities prepared also the automatic check which is the great hike to its efficiency. The system was thoroughly checked and tested with dummy data and thus found to be reliable. It generates test reports and provides facility to create automated checklist. The user can observe all these statuses in mobile via Android Application. Food wastage management system is efficient, usable and reliable. The paper work focused on reviewing the need for this food wastage management system in the real world, since it provides a good reliable solution for food wastage by providing a preventive measure than later measures that already exist like recycling.

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