

Smart Kitchen using IoT

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Abstract— With the advanced technology and numerous research on making the lifestyle a lot better, the conception of smart kitchen has been introduced. Kitchen is the important part of our lifestyle particularly when it comes to health. In this scholarly article, an innovative concept known as the Enhanced Kitchen with Quality and Quantity Monitoring (EKQQM), which serves to oversee and regulate the caliber and quantity of food items stored within the kitchen space, thereby providing regular updates to the user. This technique reduces the wastage of products and scarcity of frequently used products. The user gets the notification of the products by using a barcode scanner or an RFID module. Sensors based on temperature, moisture, load, odour, etc. are also used. The author in this article has mentioned an arrangement that can help in advancing the basic lifestyle and modifying the kitchen in a way that helps in monitoring food and reducing wastage or overstocking

Index Terms— Smart Kitchen, Enhanced Kitchen, Quality Monitoring.

I. INTRODUCTION

Smart Kitchen has been a topic of research since a long time now because of its immense use and advantages. Kitchen is the most essential place for storing food and food wastage has been a crucial topic for a significant time. Smart kitchen is a concept that adheres to both of these points as it stores food efficiently and helps in minimizing wastage of food. It keeps the owners alert of their food stocks and deterioration of items regarding quality and quantity. This is a very systematic way of organizing your kitchen and making sure the users are consuming fresh items. The modern style of living is truly benefited by such kind of a kitchen as it makes the kitchen automatically store, check, and order items based on its frequency of usage and deterioration of its quality in the matter of expiry dates. Although this technique is extremely helpful and efficient, it isn't cost-effective.

An Enhanced Kitchen with Quality and Quantity Monitoring (EKQQM) is a method to transform any kitchen into a smart kitchen having all the mentioned features and being cost-effective at the same time. The

significance of this undertaking lies in its ability to raise awareness regarding food spoilage, minimize food waste, and promote a healthier lifestyle among its users. The EKQQM can be managed by remote users, allowing them to activate or deactivate the system. Additionally, it alerts users about the scarcity of frequently utilized items through the use of RFID technology. Moreover, it simplifies the process of ordering scarce products by notifying predetermined grocery vendors via SMS or an online platform. The inclusion of a load cell aids in the monitoring of both quantity and quality.

II. LITERATURE REVIEW

A Smart Kitchen is a device that has the capability to establish communication with sensors or scanners in order to effectively monitor the inventory of stored items. The primary objectives of this system encompass the monitoring of quantity, quality, and shelf life[1]. The connection to the employer's internet company is securely embedded within the word that is transmitted to the individual through SMS (Short Message Service) and email. As sensors continue to advance, this proposed framework can be further strengthened in its ability to detect the state of a diverse range of food items, while also allowing for the transmission of messages across a wide array of device inventories. Additionally, this paper suggests the utilization of load mobile signals[2]. It uses web affiliations to buy the required products and keep track of the nature of the products. With the help of SMS or email, it can notify the user of the decreasing products. These sensors are able to notify the user on multiple gadgets. This paper proposes a method of notifying their user in ways such as warning signs, symptoms, signs, emergency, etc. This detailed report sent to the user over the smart kitchen is what causes this methodology very useful and efficient. It allows the user to understand the cause and prevention methods for their stored items.

Internet Digital DIOS, also recognized as R-S73CT, was the inaugural internet kitchen ever introduced by LG in the year 2000. The technology was the outcome of a project that commenced in 1997 and possessed a financial allocation of approximately \$49.2 million. It was manned by a team of 55 researchers [3]. A TFT-LCD (thin-film transistor liquid crystal display) screen equipped with a Local Area Network (LAN) connector was incorporated within the kitchen. It featured an LCD information window accompanied by an electronic pen, data memo, video messaging, and schedule management capabilities that exhibited information such as the internal temperature, the freshness of food in storage, nutritional details, and recipe information [4]. However, due to consumers' perception that it was superfluous and extravagant, amounting to more than \$20,000 primarily as a result of the substantial investment made in establishing a smart system, this Kitchen proved to be ineffective as a product. Another intelligent Kitchen system applicable in the pharmaceutical context was delineated in a 2007 patent. Containers primarily designated for pharmaceutical products were housed within this system [5]. During the process of adding or removing containers, Radio-Frequency Identification (RFID) technology was employed to facilitate product recognition, thereby enabling the identification of each container individually. By means of a data storage system comprised of a local or remote database, a plethora of information such as the manufacturer's details, expiration date, inventory levels, and more were effortlessly procured.

III. PROPOSED METHOD

The technique offered in this paper is Enhanced Kitchen with Quality and Quantity Monitoring (EKQQM). The goal of this method is intended to create an efficient and effective smart kitchen with accurate information and as well as cost effective. Figure1, block diagram explaining all the aim components used for this protocol is shown below.

The onboard processors and sensors utilized here benefits in sending the user data about the quality and quantity of the products stored in the kitchen. They are the main components in this protocol since the data sent to the users have to be accurate, precise, and fast regarding of communication of the SMS or email. Light Dependent Resistors (LDR) are similarly used as it helps in detecting the level of beverages, amount of vegetables, odour, etc. Radio Frequency Identification (RFID) is used in monitoring the shelf life of the products stored. Whenever a product in reaching its expiry date or on the threshold of going bad, a trigger is sent to the linked phone. The trigger is sent by an SMS. It contains a list of the specific products and how

soon will it turn bad. At hand there are various components are needed to form this. The Hardware and Software components used are listed below.

Hardware components:

1. Arduino
2. Humidity Sensor
3. Gas sensor
4. Load cell
5. Power supply

Software components:

1. Arduino IDE
2. Embedded C

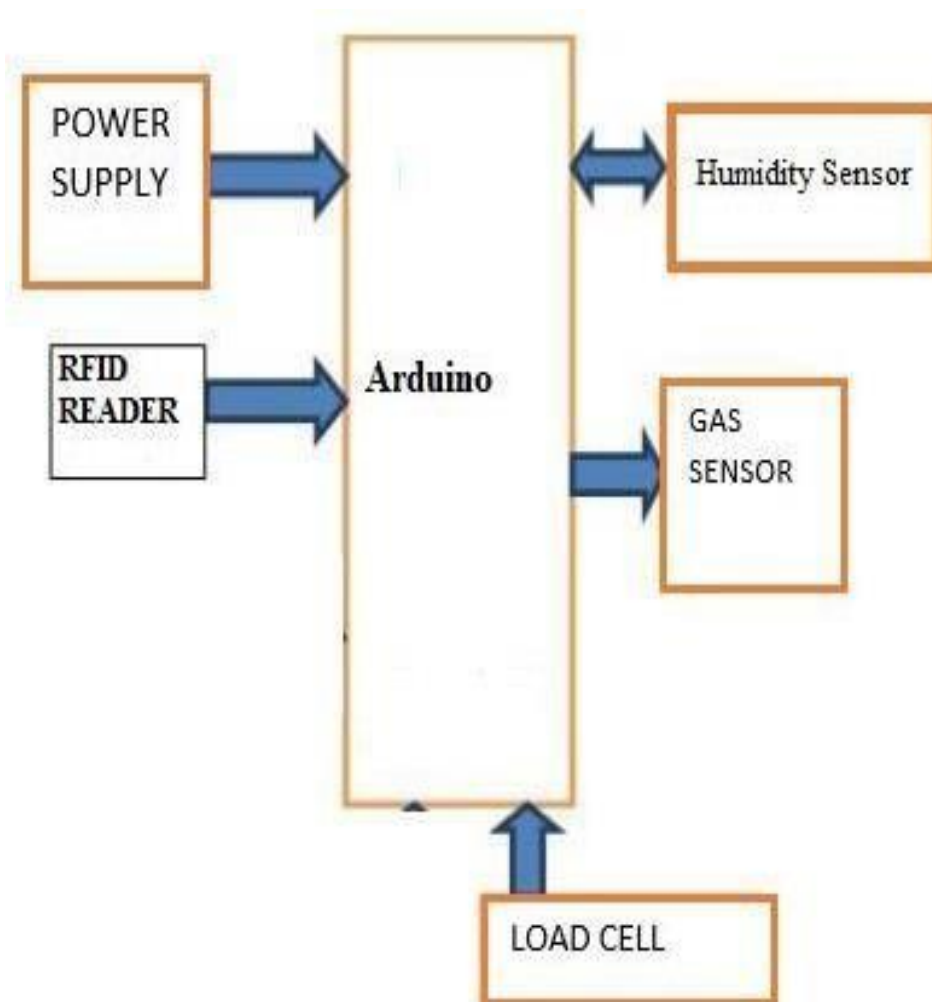


Figure 1. Block Diagram

IV. IMPLEMENTATION

The above-mentioned information processing units' components play a significant function in creating a smart kitchen device. Each of them have certain specifications and responsibilities in the design. The author has described all the component's implementation and use below.

A. Arduino

The microcontroller board, Arduino/Genuino Uno, is constructed using the ATmega328P microchip. In terms of hardware, this board encompasses 6 analog inputs and 14 digital input/output pins, with 6 of these pins having the capacity to function as Pulse Width Modulation (PWM) outputs. Moreover, the board is enhanced with a 16 MHz quartz crystal, a power jack, a USB connection, a reset button, and an ICSP header.

The microcontroller used is the ATmega328P. It operates at a voltage of 5V. The input voltage range is between 7V to 12V. The limit for the input voltage is 6V to 20V. There are 6 digital I/O pins available. Additionally, there are 6 analogue input pins. The DC current per I/O pin is limited to 20mA. The DC current for the 3.3V pin is 50mA. The flash memory has a capacity of 0.5KB, with a portion of it being utilized. The SRAM has a capacity of 2KB. The EEPROM has a capacity of 1KB. The clock speed of the microcontroller is 16MHz. The length of the microcontroller is 68.6mm. Its width is 53.4mm. Lastly, the microcontroller weighs 25g.

The microcontroller known as Arduino Uno , as shown in Figure 2, facilitates the process of loading a program onto the device for its users. The Arduino/Genuino Uno, which utilizes the ATmega328 microcontroller, comes pre-programmed with a boot-loader that offers the convenience of uploading new code without the need for an exterior hardware programmer.

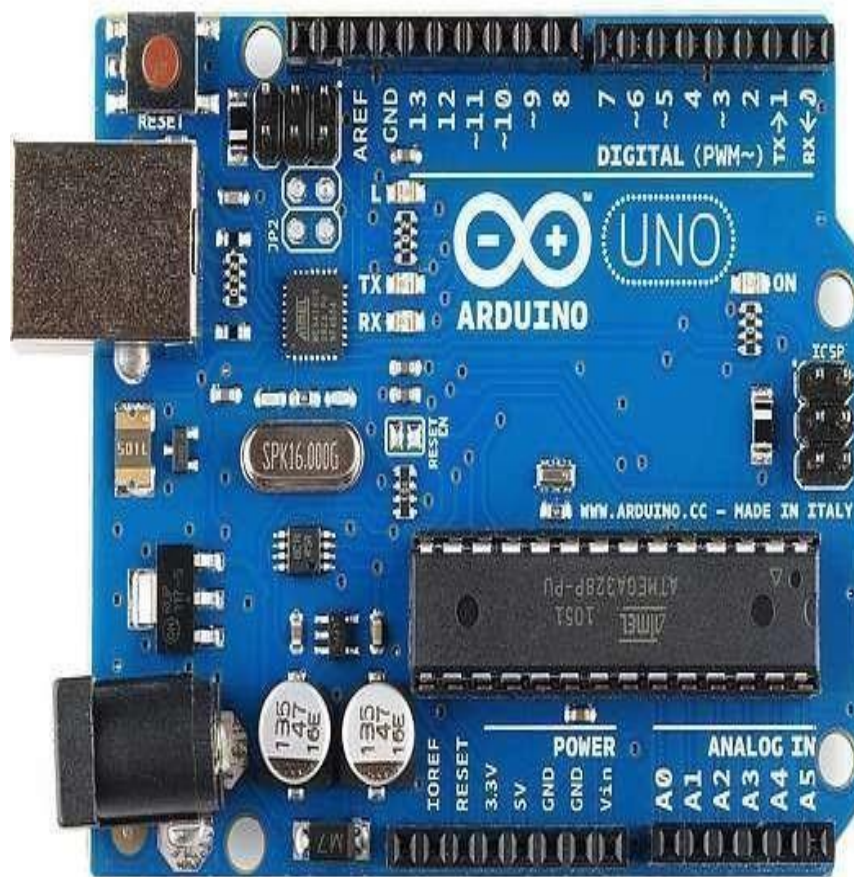


Figure. 2. Arduino

B. Humidity Sensor

The implementation of the DHT11 Humidity and Temperature Sensor yields a standardized digital output. This particular sensor possesses the capability to seamlessly integrate with various microcontrollers such as Arduino and Raspberry Pi, resulting in immediate and accurate data acquisition. Furthermore, this sensor is economically priced and exhibits a high level of reliability and long-term stability. The inclusion of a pull-up resistor within this module facilitates an effortless connection between the DHT11 sensor and the Arduino or microcontroller. In order to utilize this sensor, only three connections need to be established: Vcc, Gnd, and Output.

Specifications: -

- The power supply required for this device is in the range of 3.3 to 5.5 volts DC.
- The output of this device is in the form of a 4-pin single row.
- The measurement range for humidity is between 20 and 90 percent relative humidity (RH).
- The temperature measurement range is from 0 to 50 degrees Celsius.
- The accuracy of the humidity measurement is within a range of plus or minus 5 percent RH, while the accuracy of the temperature measurement is within a range of plus or minus 2 degrees Celsius.
- The resolution of the humidity measurement is 1 percent RH, and the resolution of the temperature measurement is 1 degree Celsius.
- This device is fully interchangeable, meaning it can be used as a replacement for similar devices.
- The long-term stability of this device is less than plus or minus 1 percent RH per year.

C. Gas Sensor

The Gas sensors are employed for the purpose of detecting various gases such as carbon monoxide, liquefied petroleum gas, propane, alcohol, hydrogen, and even methane. The sensor, in its module form, is equipped with a Digital Pin, enabling it to operate even in the absence of a microcontroller, as shown in Figure 3. This feature proves to be advantageous when one seeks to identify a particular gas. In order to measure the gas concentration in parts per million, the analog pin must be utilized. Furthermore, it should be noted that the analog pin is also TTL driven and operates at a voltage of 5V, making it compatible with most commonly used microcontrollers

Features:

- The voltage at which the device operates is +5V.
- It can be employed to detect or perceive LPG, Alcohol, Propane, Hydrogen, CO, and even methane.
- The voltage of the analog output ranges from 0V to 5V.
- The voltage of the digital output is either 0V or 5V, adhering to TTL logic.
- The duration of preheating is 20 seconds.
- It can function as either a digital or analog sensor.
- By utilizing the potentiometer, the sensitivity of the digital pin can be adjusted



Figure. 3. Gas Sensor

D. Load Sensor

The Figure 4 below shows a load sensor, which is a device that measures the weight of objects, such as vehicles. If the weight of a vehicle exceeds the threshold value (1.5kg), the gate will close. This prevents heavy vehicles from entering the bridge. It produces an analog output that cannot be interpreted using the built-in 10-bit ADC in ARDUINO. Ready to interface with microcontrollers, the 8-bit data output references the load UART output, which varies from 0 to 255. The load cell is interfaced with an SPI-based ADC chip using a microcontroller for the conversion of SPI to UART output and 8-bit output. It is easy to interface with 8-bit microcontrollers.



Figure 4. Load Sensor

E. Arduino IDE

Arduino is an open-source prototype platform based on user-friendly hardware and software. It consists of a circuit board, which can be programmed (referred to as a microcontroller), and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board. A program created using the Arduino IDE is referred to as a sketch. Drafts are saved on the development computer as text files with the file extension, .ino. The Arduino Software (IDE) prior to version 1.0 saved sketches with the extension, .pde.

The Arduino IDE employs the programming languages C and C++, incorporating specific coding structuring rules. The Arduino IDE requires a software library based on the Wiring project, which provides numerous standard input and output methods. The user-generated code comprises two fundamental functions for initiating the sketch and the main program loop. These functions are then compiled and linked with a program

stub `main()` to form an executable cyclic executive program using the GNU toolchain, which is also provided with the IDE distribution.

F. Embedded C

Embedded C is widely recognized and commonly employed as a programming language for the development of embedded systems. It is considered the standard language among embedded programmers for programming such systems, which consist of both hardware and software components. In the context of a modest embedded system, the primary hardware module is the processor, which can take the form of a microprocessor, microcontroller, DSP, or similar device.

Embedded C programming language, an extension of the C programming language, is extensively utilized in the development of embedded systems. It shares the syntax and semantics of the C programming language, including elements such as the main function, declaration of data types, variable definition, loops, functions, and statements.

V. RESULT

The result will be used to trace the resources and utility in the house. This will directly help the house hold persons by consistently letting them know about the quantity and quality of the food items stored. They can interact with their kitchen grocery from any part of the world with a single click. The proposed project represent a major step towards a self-consistent theory of "Home automation" over all the study will broaden our understanding of Home automation for the field of relation between technology and human life style. Figure 5 shown below are the images of the hardware design of the proposed method and Figure 6 shows SMS received after building the code in the system.

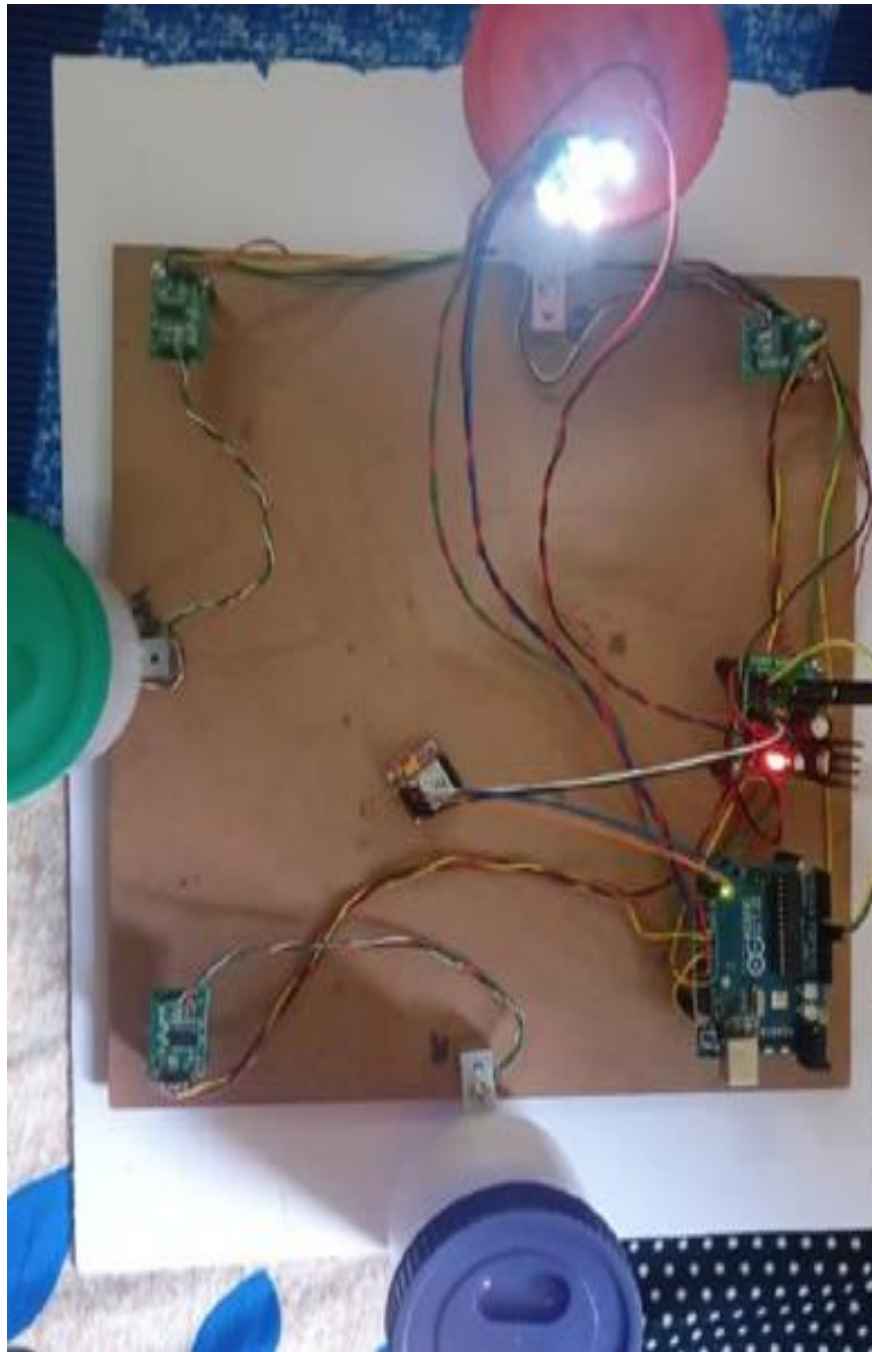


Figure. 5. Hardware of the proposed method

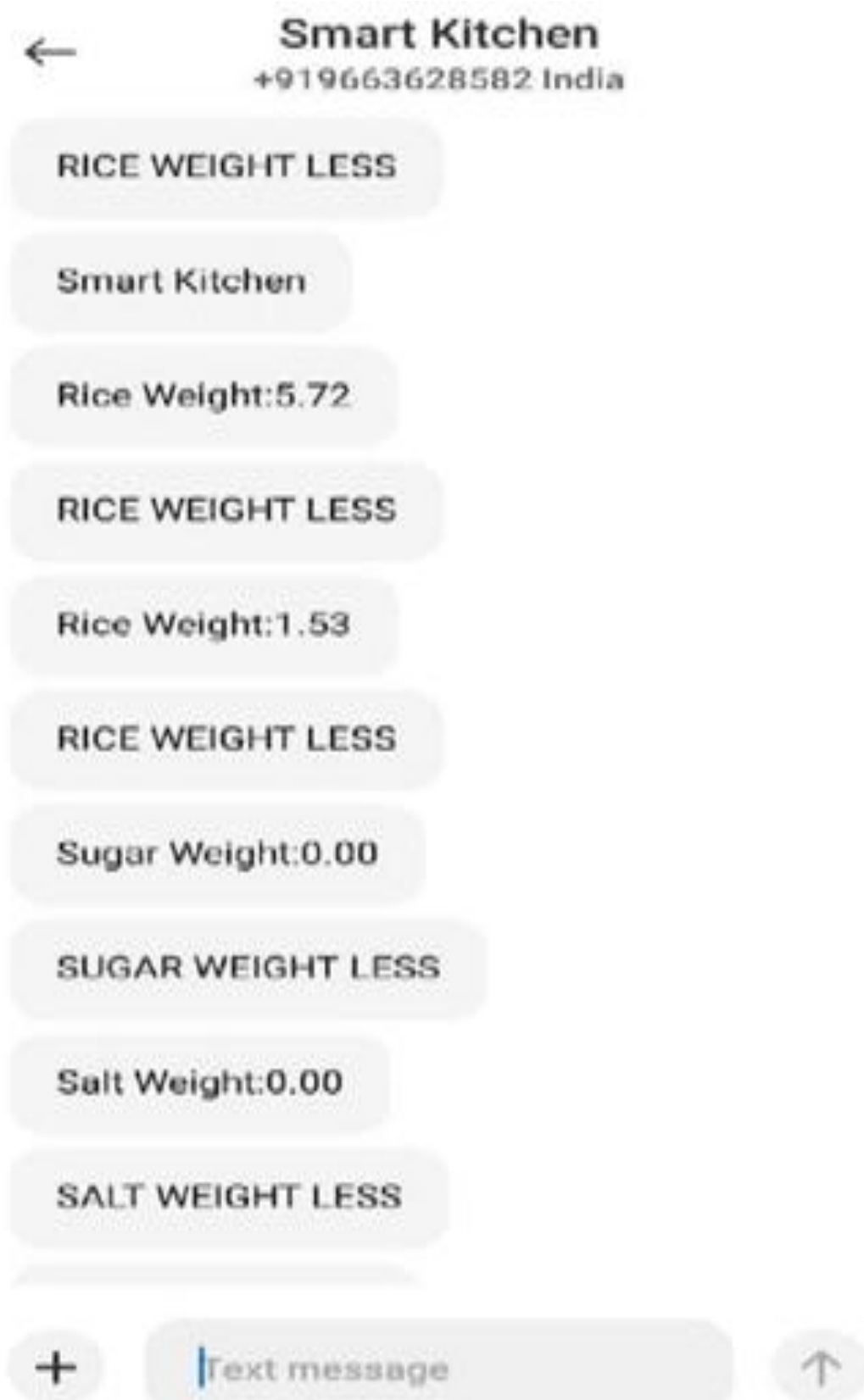


Figure. 6. SMS received

VI. CONCLUSION

Smart Kitchen is an advancement that is researched by many since the advantages of the same are numerous. The proposed method can be of a huge help when it comes to keeping the food item's quality and quantity in check. It reduces wastage of food and gives the users the benefit of a smooth running kitchen, avoiding scarcity of an essential product. The future scope of this topic includes adding an option of directly sending the list of items needed to the shop and place orders automatically.

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