ARDUINO-BASED FOOD SPOILAGE MONITORING DEVICE USING GSM.

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ABSTRACT

Food safety is essential for the economy of a country as food is a fundamental requirement for humans and significantly contributes to national development. Nowadays, the leading causes of illness in individuals are their dietary choices and limited awareness regarding food quality. Presently, people are more conscientious about their health and food choices. There is an urgent need for a technological breakthrough to address the issue of identifying food quality. One potential solution could be the development of a method for detecting and alerting about food spoilage. The main objective of this research is to detect food spoilage. These sensors continuously monitor food ingredients to determine if they have spoiled. The data collected by the sensors is then transmitted to Arduino, which uses its program to analyse the data. Subsequently, the readings of the food material are displayed, and the user is notified via GSM text message about the quality of the food material.

I. INTRODUCTION

The consumption of our food can lead to contamination from storage or chemical alterations that occur within the food. In numerous countries, a large portion of the population faces daily struggles for adequate food, with the preservation and chemical treatment of food leading to illnesses. It is essential to establish a system that enables individuals to assess the purity and quality of food products.

The food quality must be monitored to prevent spoilage in various environmental conditions such as temperature, humidity, and the characteristics of vegetables/fruits. This monitoring is essential for assessing quality using different methods. Specifically, the sensor detects changes in food quality by observing its colour. Signal processing and pattern recognition techniques are utilized to determine the timing of food consumption via sensors. Consumption of spoiled or contaminated food can lead to serious illnesses like food poisoning, which is one of the many diseases associated with spoiled food. The primary goal of the food spoilage detector is to detect gases emitted from spoiled food, alerting users to its condition. It is imperative for every nation to oversee food safety to ensure the well-being of its people and the nation's progress. A food spoilage detection system primarily relies on various sensors to

evaluate the quality of food products, thereby enhancing human health standards. Food is an essential requirement for all living organisms on Earth, sustaining life itself. Food wastage primarily occurs due to food spoilage, and by preventing spoilage, wastage can be minimized. Globally, approximately 30% to 40% of food supplies are disposed of annually due to spoilage.

The rest of this document is structured as follows: Section II covers the introduction of contemporary technologies that aim to identify unhealthy food items through various questionnaires. Section III involves experimentation with Arduino UNO in electronics and coding. Section IV presents an overview of Arduino IDE for coding on the Arduino Device. Finally, Section V outlines the operational system for detecting and alerting users about food spoilage to ascertain the source of food materials.

II. LITERATURE SURVEY

The rise of modern technology has led to an increasing demand for intelligent application development, highlighting the need for society to identify spoiled food effectively. Various surveys have been established to determine the quality of food items, with some focusing on tracking moisture and humidity levels in food products using diverse sensors [1]. Food should not remain stationary but should be transferred to different locations, necessitating the use of sensors embedded in the food to monitor its condition continuously during transportation. One advancement involves the real-time tracking of food components to notify users of their status, thus preventing food spoilage, through the utilization of Bluetooth Low Energy (BLE) and the Internet of Things (IOT). By incorporating modern tools like GPS and GSM into the system, users can receive frequent updates regarding their food items and potentially reduce the 30-40% of global food waste caused by food decay each year. To combat this waste, innovative methods must be devised to prevent it, such as employing various sensors to constantly assess food materials for signs of spoilage and notifying users through diverse devices, ultimately reducing food wastage on a global scale through effective food preservation practices. Nutrition is essential for life on Earth, providing us with the energy to function and the health to live fulfilling lives. Ensuring individuals consume a healthy diet is crucial not only for their well-being but also for the economic prosperity of a country. Eating spoiled food can lead to illness and indirectly impact a nation's economy. Therefore, the development of a device utilizing a range of biosensors is necessary to identify fresh food accurately.

The aim of this project is to establish a system capable recognizing the stages of spoilage and informing individuals about the freshness status. This tool can assist people in understanding the shelf life of items and preserving them for future use. By utilizing GSM technology, the device can send an SMS or place a call to retrieve the necessary details.

The system should be able to determine the freshness of food. The components utilized in the design of the system include the Arduino UNO R3, GSM module, DHT11 sensor, MQ6 gas sensor, LED, buzzer, and power supply unit. The necessary software components are the Arduino IDE compiler and online tools. The main objective of the system is to identify components within solid meals. It consists of two main modules: a GSM unit that alerts the appropriate individual or authority regarding the food's condition by sending a notification to a designated number, and a food spoilage detection system that utilizes an Arduino to identify spoiled food.

III. ARDUINO UNO

If you are looking to explore the realm of electronics and coding, the UNO board is the ideal choice to start with. For beginners, the UNO board stands out as the most resilient option on the platform for experimentation. Among all the Arduino boards available, the UNO holds the top spot for being highly utilized and extensively documented.

Fig 1: Arduino uno

- The Arduino Uno is a small computer chip that can be programmed to perform various tasks. The device comprises a 16 MHz quartz crystal, 6 analog inputs, 14 digital input/output pins (6 of which can be used as PWM outputs), a USB port, a power jack, an ICSP header, and a reset button. the microcontroller comes with everything needed to operate it, all you must do is power it with an AC-to-DC adapter or battery or connect it to a computer via a USB cable to start using it. There is no need to worry about messing up your UNO game, even if you do, you can easily fix it by changing the chip and starting over for a small fee. the word "Uno" in Italian signifies one, and it was selected to honor the launch of the Arduino Software (IDE) 10. the original versions of Arduino were the Uno board and version 10. of the Arduino Software (IDE), which have been updated to newer versions. the Arduino Uno is the main model of the Arduino platform and the first in a series of USB Arduino boards. the Arduino index of boards contains a complete record of past, current, and obsolete boards.

IV. SOFTWARE TOOLS

Introduction to Arduino IDE

Arduino.cc provides official software called the IDE (Integrated Development Environment), which is primarily used for creating, compiling, and uploading code to the Arduino device. this program is free and can be easily installed and used to create code for any Arduino module.

This tutorial will guide you through the software's introductory steps, installation procedures, and configuration for the required Arduino module. Let us delve deeper into the complexities of this software.

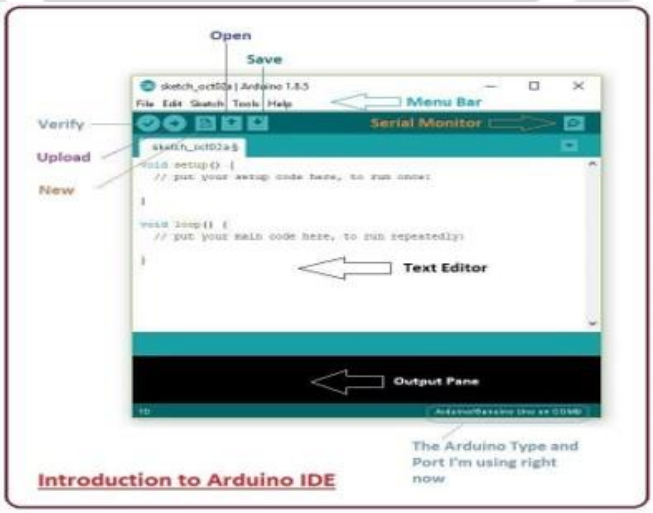

Fig 2: Arduino IDE

- The software that is used for developing and assembling code for Arduino modules is open sourced.
- Even a lay person with no prior technical experience may be able to learn how to code thanks to the simple nature of the program.
- It runs on the Java platform, which is readily available for other operating systems. The Java platform has built-in functions and commands that are needed for a wide range of tasks.
- There are many different modules that can be purchased, such as the Leonardo, Arduino Micro, and many others.
- The modules can receive code as input and are preprogrammed. The core code, sometimes referred to as a sketch, written on the IDE platform will eventually produce a Hex File, which is uploaded and sent to the board's controller.

•The editor and the compiler are the primary components of the environment. The editor is used to write the code, and the compiler is used to make the code readable. This environment supports both C and C++.

V. WORKING

- A system for identifying and warning users of food degradation is used to determine if food has soured.
- The diagram shows the system's flow but also explains how it works.
- The system uses the sensors to sense the value The temperature and gas in which the threshold is set are detected by the two sensors. Text is sent to recipients when the threshold value is exceeded.
- The most popular temperature and humidity sensor is the DHT11. You can either buy the sensor as a module or as a sensor.
- The current values of the atmosphere are measured when the system is turned on. The food will be monitored by the system's sensors when it is near them.
- After analyzing the data in accordance with the preset threshold conditions, the data is sent to the board, which interacts with the output devices to show the results in a serial form.
- The system takes a reading of the current atmospheric conditions when it is activated. When the food is kept close to the sensors, they will be able to sense data from it.
- The code that is implemented in this way applies the same as the rest of the procedure.
- If there is a mistake in the process implementation, it does not work.
- When a food item is found to be spoiled, a text message is sent with the message, "Food Spoilage is detected.
- "When we receive this text message, we should check to see if any food has gone bad and replace or clean the system.
- The current values of the atmosphere are measured after the system starts. When the food is kept close to the sensors, they will be able to sense data from it.
- There are three phases, each with a different temperature and gas sensor value. The meal is good if the value falls between two values. The food tastes good.
- The sensor requires you to use the built-in pull-up resistors and filters if needed, whereas the module has built-in pull-up resistors and filters. That's the only difference between the two.
- The value that falls between the preset range is measured by the sensor during the second phase. A message is sent if the value falls between those ranges.
- A value that falls inside the specified range is detected by the sensor in the third phase. A message is sent if the value falls within that range.
- The final stage text tells you if the food is worth more than the set levels.

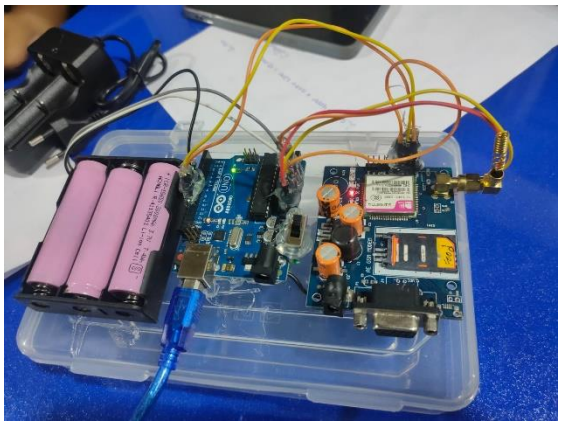

Fig 3: Hardware kit 1

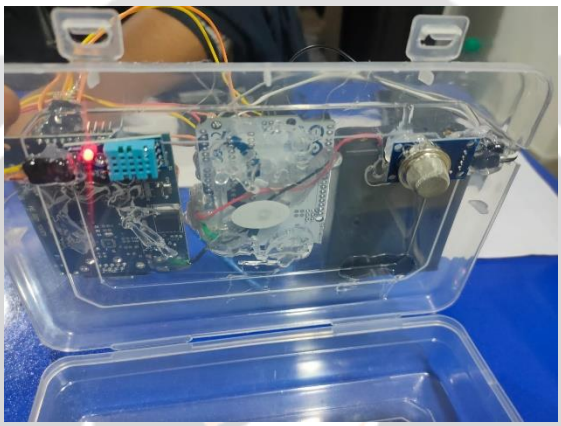

Fig 4: Hardware kit2

CONCLUSION:

In conclusion, food is a severe threat to the environment, economy, and food safety. Food degradation needs to be identified and treated to reduce these problems. We can fundamentally change how we track and manage the conditions of food storage with the use of sensor technology.

With the use of state-of-the-art technologies, we empower individuals, groups, and industries to actively monitor food surroundings, recognize early signs of degradation, and take necessary preventive action. This reduces food waste and financial losses while at the same time enhancing food safety and security for consumers. As we develop and enhance these sensor-based systems, it is important to have a baseline price, scale, and accessibility. Different user needs and operating scenarios should be considered when developing new solutions.

Collaboration between researchers, legislators, industry stakeholders, and the public is necessary to foster innovation, share best practices, and guarantee the widespread adoption of food spoilage detection systems. By working together, we can create a food system that is more robust and sustainable, protecting the planet's resources while meeting the needs of the current and coming generations.

Efforts, inventive solutions, and teamwork are needed to prevent food spoiling. We can completely transform how we recognize, prevent, and manage food, leading to a safer, more sustainable, and efficient food supply chain that is beneficial to all parties involved. The advancement of internet of things-based technologies can help achieve this.

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