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SURVEY OF VARIOUS AUTOMATED COOKING SYSTEMS

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Abstract: Modern sensors, the Internet of Things, and artificial intelligence are advancing automation at a rapid rate. Every person and industry now consider automation to be a requirement. Many industries, including banking, the hotel industry, the automotive industry, and education are best served by automation. Automation in the kitchen has pushed the boundaries of inventiveness, such as the microwave oven, mixer, and grinder. Choosing something from the menu might be. The Internet of Things has, on the other hand, already changed how people live. The system will become more sophisticated and application-sensitive if reinforcement learning is introduced to it. In this study, we provide a detailed overview of the existing in use automated cooking systems and discuss about a number of innovative, developing technologies and solutions that can be used to efficiently automate the cooking process.
Keywords: IoT, PLC, Automation, Artificial Intelligence, Reinforcement learning, Cooking System

INTRODUCTION:

Automation is taking over every space of life. This fast life has given ride to everything one such area is Kitchen and specifically cooking. Using automation for cooking will ease many complexities and will bring simplicity. IoT will add value of making it happen from anywhere. Reinforcement Learning if added to it will make the system more intelligent and sensitive to the application. Since food is one of our fundamental requirements, cooking has become a need for humans. Cookware is used in a wide variety of people; thus, it keeps evolving into a modern convenience. Up until now, all culinary tools have been hand-held devices. Despite the fact that everyone's business is booming these days, a cooking device that can cook itself is still required. The usage of artificial intelligence (AI) techniques, on the other hand, is growing as a complement to traditional methods or as a component of integrated systems. These days, they are getting more and more popular and have been employed to resolve challenging practical issues in a variety of fields. AI has been used and implemented in a variety of fields, including medicine, the military, engineering, marine industry, medicine, the military, and economics. Additionally, they have been used to model, identify, optimise, predict, forecast, and regulate complex systems. The term artificial intelligence (AI) refers to a machine's or an artifact's successfully carry out similar types of work to those that differentiate human thought. According to the background information and analysis of the research that has been given, we require a device that can automate and customize the cooking process. The fundamental idea is to develop a cooking device that can run autonomously without human interaction. So, cooperation between human intelligence and IoT is required to build this device.

OVERVIEW OF DIFFERENT TECHNIQUES FOR AUTOMATING COOKING PROCESS:

2.1 HMI Based automatic Cooking Machine [2]:

A well-designed cooking mechanism called HMI Based is intended to cook food without human involvement by pressing only few buttons. The user can select the recipe and change the built in timers and ingredient amounts in this machine based on human need. Reed and limit input switches, a Delta made

DVP14SS11R2 programme logic controller, a human machine interface (HMI) for choosing the recipe make up an HMI-based machine. These systems are used for mass production cooking, which preserves food quality and flavour and is beneficial to the hotel and food chain industries.

2.2 PLC based Automatic Cooking Machine [1]:

Making cooking simpler, quicker, and easier is the goal of a PLC-based automatic cooking system. You only need to choose the recipe you want to eat; the appliance will handle the rest and notify you when it's ready.

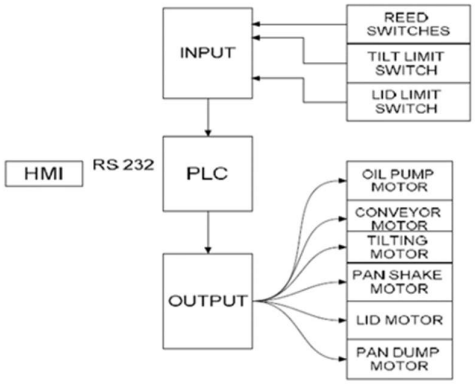

Figure 1- Block Diagram

Your preferred recipes will be pre-loaded in the appliance, and a C language programme will be used to configure the amount of ingredients. This machine can make food that is almost identical to what can be made by a human hand. Every aspect of the machine's operation is managed by an Arduino2560 kit, which is used to communicate with the machine via an HMI interface.

2.3 HMI and PLC based Automated Cooking system [3]:

The three systems included in this automated cooking device are step-by-step ingredient addition, stirring, and frying etc. A stirrer, Steel bowels, a water and oil pump, a hot plate, and a panel positioned next to the machine are all components of an automated cooking device. Each of the devices used in the cooking process is under the direction of an HMI and a programme logic controller. With such an automated cooking device, it is simple to maintain proper maintenance and can deep fry and stir fry like a human cook. The following are the goals of this device: - It will carry out cooking automatically. It will produce a variety of veggies. We are able to keep or save the recipes, and we can adjust the quantity to fit the number of individuals. The taste will also be repeated as needed.

Figure 2- Front view of cooking machine.

This machine is mostly based on mechanical and electrical components with PLC programming. By utilising the automated cooking equipment, this machine will save material waste and reduce labour costs.

2.4 Automated Food maker using IoT [7]:

The basic ingredients must be included in an automated food maker's recipe, and then the user must select a dish from a pre-set menu. For the device's implementation, they employed containers for both solid and liquid materials. All of the operations of the automated food maker are also controlled by microcontrollers based on the Arduino Mega 2560.

2.5 Internet of Things (IoT) based Smart Kitchen [6]:

Most obstacles can be overcome with this technique. It sends a warning message to the customer by SMS; however, its biggest flaw is the cost. As a result of the user, the system is costly and inefficient. When there is a gas concentration at the gas sensors' inputs, this system has the ability to send SMS notifications. So, both private residences and large structures like hotels and restaurants can use this technology. You can access all the automation capabilities in a smart kitchen, including safety features like a gas leak monitoring system.

2.6 Automation and Monitoring Smart Kitchen based on IOT [5]:

This system handles all of the automated tasks performed in the kitchen. Infrared (IR) sensors are used to detect flames, infrared (PIR) sensors to detect motion, infrared (MQ235) sensors to detect gas leaks, and infrared (DHT11) sensors to detect temperature. This system depends on apps and needs a constant internet connection. Remote areas cannot maintain a constant internet connection, which raises the likelihood of an accident.

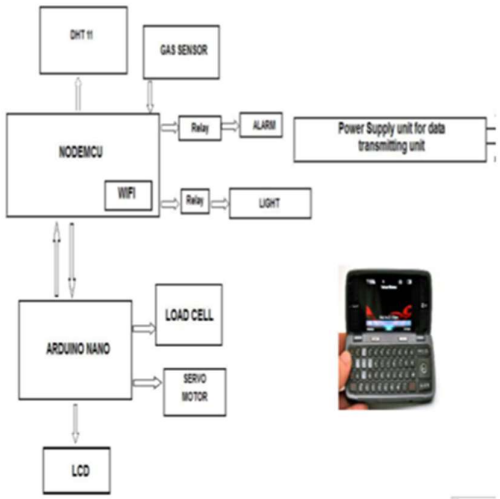

Figure 3- Block Diagram

2.7 Automated Cooker Technique using IoT [9]:

Utilizing the Internet of Things (IoT) technology, an embedded system's implementation and evaluation enhances the ability to control how long food items are cooked. This system, which will be an embedded system using avr-atmeg32, enables the chef to select from a variety of timers for various meals, and all timers can operate concurrently to prevent food losses and the hiring of extra staff.

2.8 Modern Automatic Cooking Machine Using Arduino Mega and IOT [11]:

By using ATmega2560 as its base, the Arduino Mega 2560 microcontroller board is utilized in a novel automated cooking device. An object can be accurately pushed or spun by a mechanical device known as a servo motor. For regulating how the shaft moves and how it is finished, it comprises of a controlled device, an output sensor, and a feedback system. Electromechanically opening and closing the system has been accomplished using relay switches. The valve is precisely opened or closed by the solenoid valve. Rubber or metal seals may be used on solenoid valves, and they may also include electrical control connections. A spring may hold the valve open or closed when it isn't being operated.

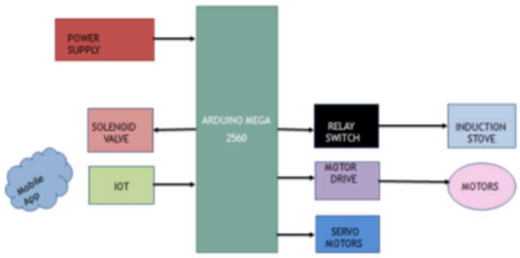

Figure 4- Block diagram of a new automatic cooking machine

2.9 Recipe Generation Using Reinforcement Learning [8]:

A recipe–generation model is encoder– decoder framework. The elements in cooking recipes are not accurately reflected by models created using the classic encoder-decoder framework, but the suggested solution includes reinforcement learning and coverage loss. On a dataset of around 15 K cooking recipes that were extracted from Food.com, the model was empirically

tested. Ingredient matching (IM), a novel evaluation metric that shows how much the recipe employs the input ingredients, served as the evaluation index.

2.10 Future Smart Cooking Machine based on Artificial Intelligence [10]:
A smart cooking machine that can save cooking time and make cooking easier for people is planned for the future. This large square-shaped machine has multiple holes for storing food ingredients. In that device, a robotic arm will be provided that can be used to prepare food ingredients that are positioned in reachable apertures into desired dishes. The robot arm that the artificial intelligence mechanism is developing with is called LeJOS. The outcome is shown on a touch screen.
2.11 Robotic Cooking Using Batch Bayesian Optimization [10]:
The idea of robotic food quality optimization is presented in this paper along with an effective and dependable optimization procedure for enhancing food flavour. To address the primary issues with qualitative data, optimization is used. With its version, Batch Bayesian Optimization, as a better extension, the basic Sequential Bayesian Optimization method is particularly well suited for expensive, noisy low-dimensional cost functions.
2.12 Automatic Judgment of Food Color and Cooking Conditions with Artificial Intelligence Technology [12]:
Artificial intelligence and machine learning algorithms were utilised to quickly assess the level of cooking of foods and prevent overcooking. The real-time image processing technology and software for development were used in conjunction with the camera to acquire information on the food's colour. Through the use of calculation parameters, the food's state of cooking was also monitored.
2.13 Machine learning algorithms for the automated classification [15]:
The current study shows how to quickly detect fungal contamination in maize by combining IR spectroscopy with cutting-edge machine learning techniques. The developed method advances the analysis of protein and carbohydrate content fluctuations that are related to toxin contamination levels as demonstrated in the accompanying IR spectra. A number of machine learning methods, including Random Forests, Adaptive Boosting (AdaBoost), Multilayer Perceptron (MLP), and Support Vector Machine (SVM), demonstrated effective classification and validation performance using the obtained IR-spectra.
2.14 Wi-Fi Controlled Automatic Food Maker [4]:
The Wi-Fi controlled automatic food maker machine prepares the food according to the application that has been uploaded to the Arduino atmega2560 board.

Figure 5- Block diagram of the Wi-Fi controlled automatic food maker

Wi-Fi controlled autonomous food makers save time and energy by removing the need for human involvement in meal preparation. By cooking their own meals, people with busy

schedules can better manage their hectic routines. They can also take care of their own health by cooking hygienic meals.

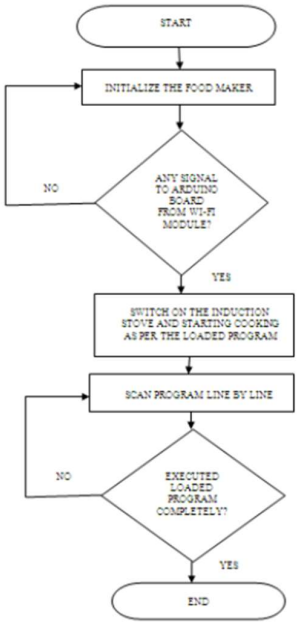

Figure 6- Flow chart for Wi-Fi controlled automatic food maker

Conclusion:

The need to automate and customize the cooking process is obvious for social, medical and industrial purposes. Cooking system is automated using Sensors, PLC, HIM and machine Learning algorithms. However, it is studied that none of the system is customizable and needs professional installation. There is no provision to check Quality of cooking and the cooked item. More precisionary results can be achieved with the use of modern algorithms in the cooking automation. A device for personal cooking from remote distance will be the future scope of this review carried out.

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