

Future Smart Cooking Machine System Design

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Abstrak

Ada banyak alat yang membuat tugas manusia lebih mudah. Memasak telah menjadi kebutuhan dasar bagi manusia, karena makanan merupakan salah satu kebutuhan dasar manusia. Sampai saat ini, peralatan memasak yang umum digunakan masih merupakan alat tangan. Karena setiap orang memiliki aktivitas yang tinggi, kehadiran alat memasak yang dapat melakukan pekerjaan memasak dengan sendirinya menjadi diperlukan. Mesin memasak masa depan yang pintar adalah mesin kecerdasan buatan yang dapat melakukan pekerjaan memasak secara otomatis. Dengan desain sistem ini, waktu diminimalkan dan kemudahan kerja diharapkan akan tercapai. Pengembangan sistem pada penelitian ini dengan metoda "system development life cycle" (SDLC). Metoda purwarupa yang digunakan dalam sistem ini adalah dengan pendekatan purwarupa "throw-away". Pada akhir penelitian ini akan diproduksi desain sistem mesin memasak termasuk mesin desain fisik dan desain antarmuka.

Kata kunci: kecerdasan buatan, mesin memasak, robotika, SDLC

Abstract

There are many tools make human task get easier. Cooking has become a basic necessity for human beings, since food is one of basic human needs. Until now, the cooking equipment being used is still a hand tool. However everyone has slightly high activity. The presence of cooking tools that can do the cooking work by itself is now necessary. Future smart cooking machine is an artificial intelligence machine that can do cooking work automatically. With this system design, the time is minimized and the ease of work is expected to be achieved. The development of this system is carried out with system development life cycle (SDLC) methods. Prototyping method used in this system is a throw-away prototyping approach. At the end of this research there will be produced a cooking machine system design including physical design engine and interface design.

Keywords: artificial intelligence, cooking machine, robotic, SDLC

1. Introduction

Cooking has become a basic necessity for human beings, since food is one of the basic human needs. People use a variety of cookware which means it continues to develop into a modern everyday. Until now, the cooking equipment used is a tool used by human hand. Though nowadays everyone business is high, then the cooking appliance that can cook itself is necessary.

A smart kitchen system has been previously designed [1]. But this system is different with the proposed system. Smart Cooking System is just a simple box with robotic arm inside.

In this paper, the tool called future smart cooking machines that can minimize cooking time and makes it easier for humans to do the cooking task is designed. This tool is large square size dimension and has many slots to put the food ingredients. In this tool there will be a robotic arm that will be useful for processing food ingredients lies in available slots into desired dishes. The movement of robot arm can occur by using the Artificial Intelligence program called LeJOS. For the operation, there will be a touch screen that display in this tool.

The paper shows the design of system and interface of the touch screen using activity diagrams, and also the interfaces of the machine form using Blender.

2. Smart Systems

Artificial Intelligence (AI)

Artificial intelligence (AI) is a term that in its broadest sense would mean the ability of a machine or artefact to perform similar kinds of functions that characterize human thought [2]. Artificial intelligence (AI) techniques are becoming useful as alternate approaches to conventional techniques or as components of integrated systems. They have been used to solve complicated practical problems in various areas and are becoming more and more popular nowadays. AI have been used and applied in different sectors, such as engineering, economics, medicine, military, marine, etc. They have also been applied for modeling, identification, optimization, prediction, forecasting, and control of complex systems [3].

Android

Android is an operating system for smartphones made by Google Corporation. This operating system was developed by utilizing the Linux kernel. The latest stable version of Android is Honeycomb 3.1 which was released in May 2011 with Linux version 6.2.37. In this version Android features already equipped with High performance Wi-Fi lock, Download manager, Streaming audio formats and also chrome version 8 browser using HTML5. In the 3.0 version to the mobile device is no longer used but the handheld mobile devices using mobile devices in tablet form, which has a larger size, approximately two-fold in the appeal of ordinary mobile device [4].

LeJOS

Lego Mindstorms NXT and the LeJOS programming environment is an ideal system for advanced software development courses. The programmable brick supports Bluetooth version 2.0+ EDR communications using the serial port protocol. It is a Class II device, giving a non-line-of-sight communications distance of up to 10 meters, or roughly 30 feet. Because of this, it is possible to use Bluetooth enabled computers, cellular phones, and control devices, like Wii Remotes or Xbox 360 controllers, to control a NXT robot, as well as receive sensor feedback from the motors and attached sensors. This is good for an advanced software engineering course because it enables the assignment of a project requiring communications with other pieces of software, adding complexity to the system and exposing students to programming networked software [5].

3. Research Method

Prototyping method is a widely system development methods used. Prototyping methods can provide a facility for developers and users to interact in the process of making a system, so that developers can easily model the system created. Prototyping method is very suitable to be applied to high risk problems, not well structured, a big change from time to time, and the uncertain data requirements.

There are three main methods of prototyping approaches. There are throw-away, incremental, and evolutionary prototyping. In the throw-away method, prototype created and tested and the experience gained from creating prototype is used to make the final products, then the prototype is discarded (not used). In independent method, the final product is created as separate components. Overall design of the final product is only one, but divided into smaller separated components (independent). In evolutionary method, the prototype is not discarded but used for the next design iteration. In this case, the system or the actual product is seen as an evolution of the initial version of a very limited towards the final product.

Throw-away prototyping method is classified into System Development Life Cycle (SDLC) methods, and it is the type of SDLC Rapid Application Development (RAD) [6]. In Throw-away prototyping method, an interface model is functionally no need to run properly, but it can provide a general overview of the system to be running. By making a prototype, developers can evaluate the product and receive suggestions directly to the system so the changes made in the early stages of development. So the effort and cost required to make changes can be minimized.

To model a system, prototyping method has some steps in the development process. This step is what will determine the success of a system. The main stages in the throw-away prototyping method are planning, analysis, design, and implementation [7].

4. Discussion

This section will explain the design of the plan and its engine design diagram described.

4.1. Planning

This design begins with scheduling. The first schedule is to determine the necessary components that will appear in the system. These include the need for cooking devices, hardware, and software. Next schedule is discussing the system design on how the system will work as a whole. The system that will be created is illustrated to diagrams form to simplify the process of understanding. The diagrams that will be used in the description of the system are the use case diagram, sequence diagram and activity diagram. Next schedule is creating the design for the virtual model of the cooking device with its supporting components. And in the end is designing the application interface implanted into the system.

4.2. Problem Analysis

The main concept in system design is to build a cooking device that can work automatically without controlled by humans. So to build this system, it is required a combination between human intelligence, computer, robotics (robot arm) and cookware, the main stove. So it can be assumed that the system needs the completeness cookware placed in the device includes a heater (stove), storage (pots, pans, fridge, etc.), cutlery (knives, etc.), stirrer (robotic arm).

This system needs a program that requires the AI to control it during the cooking process takes place. To allow a user to operate it, touch screen components are added to make it more interactive. Then it needs an easy interactive application interface designed.

Thus, in the next stage, the design phase, there are several things need to be created that is the design of system (how the system will work as a whole), the design of architectural models of devices, and user interface design.

4.3. Design

This section will discuss the diagram of the system design, which will discuss the three major sections of this cooking system.

System Design

This system consists of three main functions (Figure 1), adds the food menu function, cooking function, heating function. On the food menu function (Figure 2), user can add data foods that will be cooked into the database engine. The user should input a category, ingredients and dishes into a database as well as the details of the cooking process.

In cooking function (Figure 3), the user can do cooking process by first entering all the ingredients and seasoning required and selecting dishes that exist in the database engine. Later, the machine will automatically cook in the order process on the database. Progress bar is displayed while cooking machine.

In the heating function (Figure 4), the user can warm the food. The way is only by entering the food to be heated into the machine. After that the user set the length of time to heat up. Figure 1 shows a Use Case diagram of this system.

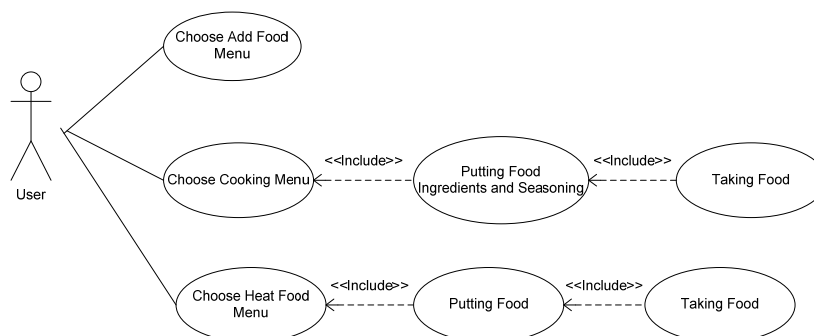


Figure 1. Use Case diagram of smart cooking machine

Figure 2, Figure 3 and Figure 4 show activity diagrams for each function.

Adds the food menu function

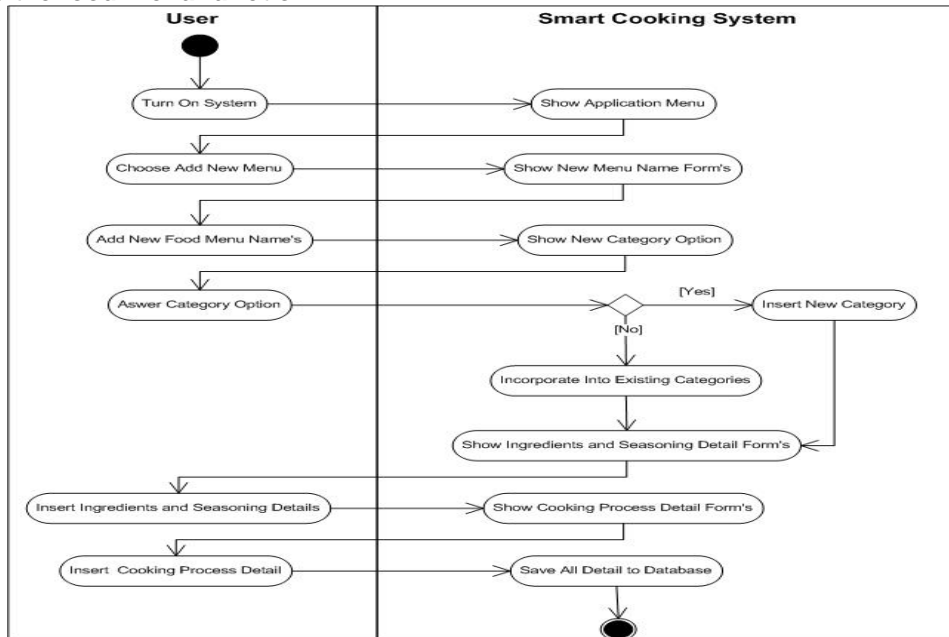


Figure 2. Activity diagram of add menu function

Cooking function

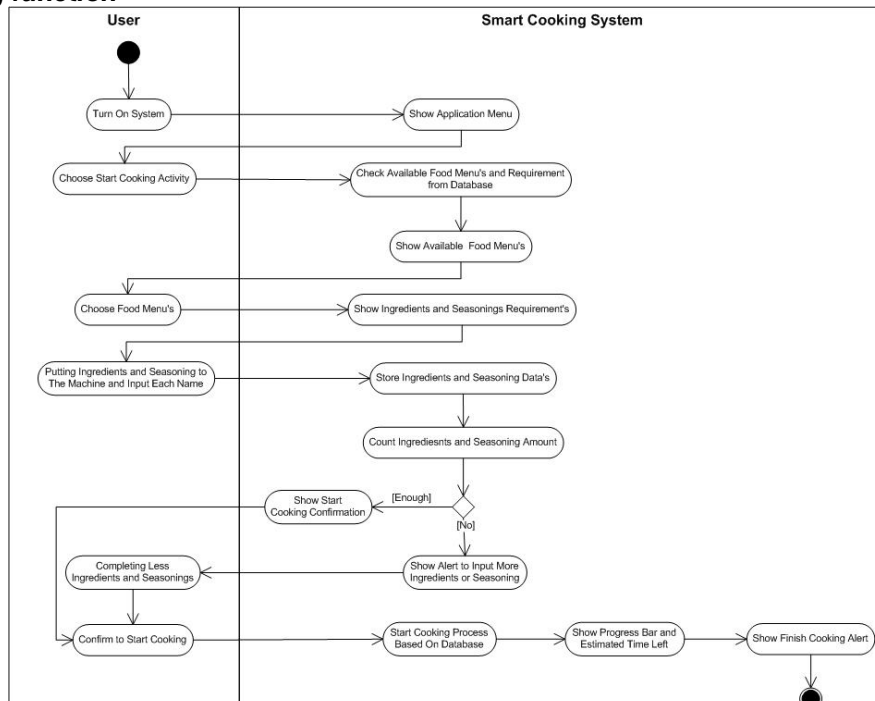


Figure 3. Activity diagram of cooking function

Heating Function

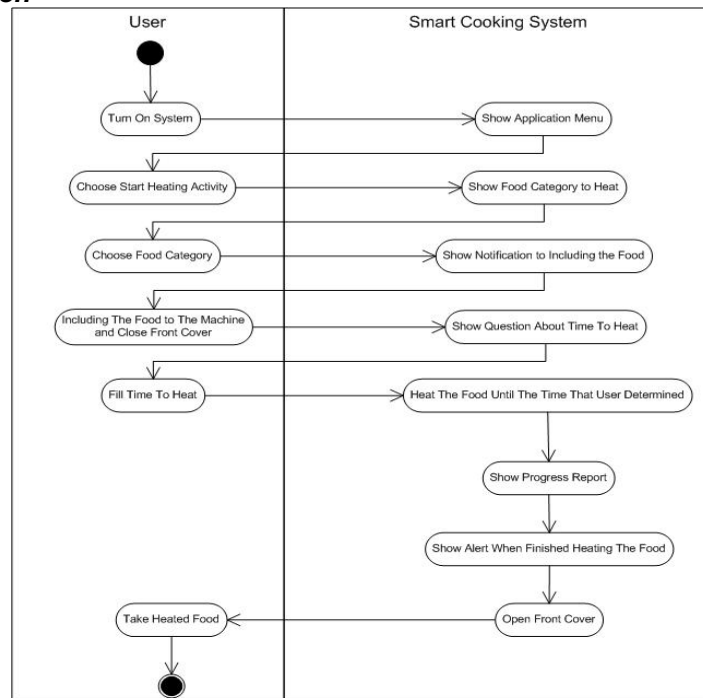


Figure 4. Activity diagram of heating food function

Figure 5 illustrates Sequence Diagram of the system.

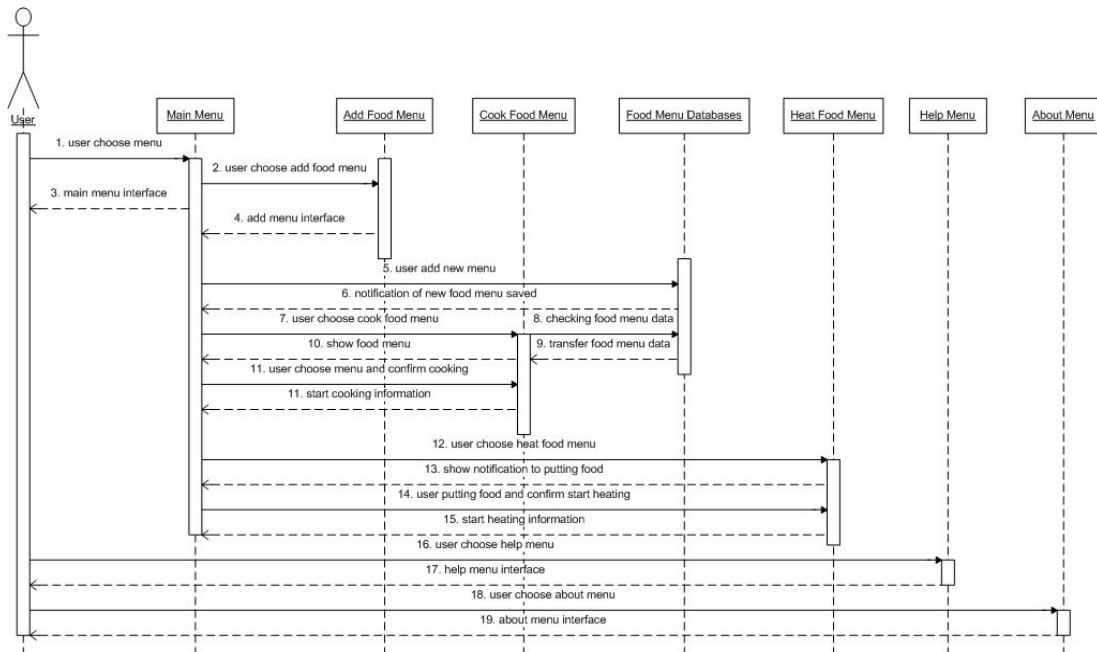


Figure 5. Sequence diagram of smart cooking machine

In the sequence diagram (Figure 5), it is illustrated how the interaction between the user with the system when selecting Smart Cooking Machine menu. If the user selects adds the food

menu data menus, the user will be prompted to enter the data required by the system, then the data will be stored in the database system.

If the user selects a menu to cook, then the user must first determine what the menu will be cooked, and then the machine will check the database for a variety of detail required, after which the user must enter the ingredients and spices are necessary, and the cooking process will be initiated where the user will be shown the cooking progress by the system.

If the user selects the menu heating the food, then the user will be prompted to enter the food system to be heated, then the system will ask for confirmation to user when heating food. After that, the machine will heat up the dishes and show food heating progress to the user. There are also some windows explaining this system, and a help menu contains the user guide for beginners to operate the Smart Cooking Machine.

Model Design

Figure 6(a) and 6(b) show the design of a 3D image in detail of the cooking system. The design that will be displayed is a front and inside.

Front View Device Model Draft and Inside View Device Model Draft

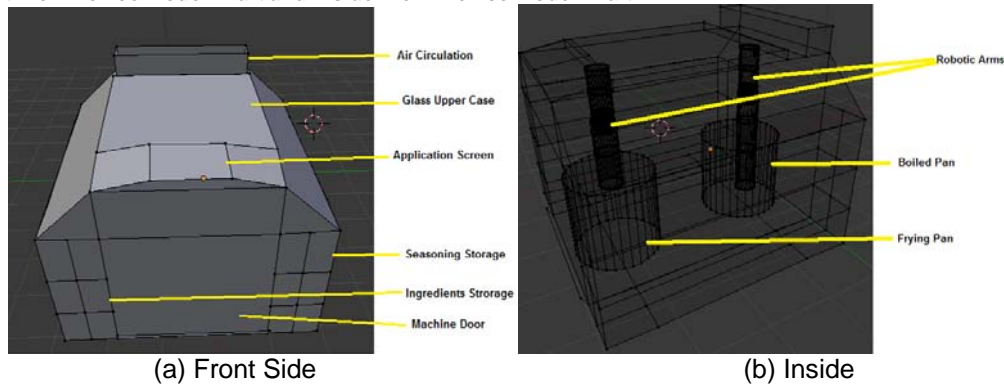


Figure 6. Device Design

In Figure 6(a), there is shown a front view of the machine, where there is a slot to put food ingredients and seasonings. At the top of the display there is an air circulation along with the application screen to operate the system. Figure 6(b) shows the inside looks of this machine, there is a robotic arm, boiled pan, and frying pan.

Interface Design

There are some interfaces designed.

The Main Window Interface Design and Food Menus Interface Design



Figure 7. Main and Food Menu Interface

Figure 7(a) will be displayed when the application executed. In this window there is a button that will direct the user to start the cooking process. Figure 7(b) is a window that will display all menus registered in the database system. In this window, the user can select the food type will be cooked. The user can select more than one food for one cooking process. When the cook button is clicked, the user will be directed to the ingredients window. And the add button will direct the user to the new menu window.

Figure 8(a) displays all the ingredients required to cook the food determined. If the ingredients are insufficient, an icon warning will appear next to the ingredient. When the entire ingredients are available the user can click the confirm button to start the cooking process. Figure 8(b) shows the form to input the ingredients required to make the foods that has not been registered in the database. The ingredient entered will be displayed in the list of ingredients table. When the submit button is clicked, the system will store these ingredients into the database.

The Ingredients Interface Design and New Menu Interface Design

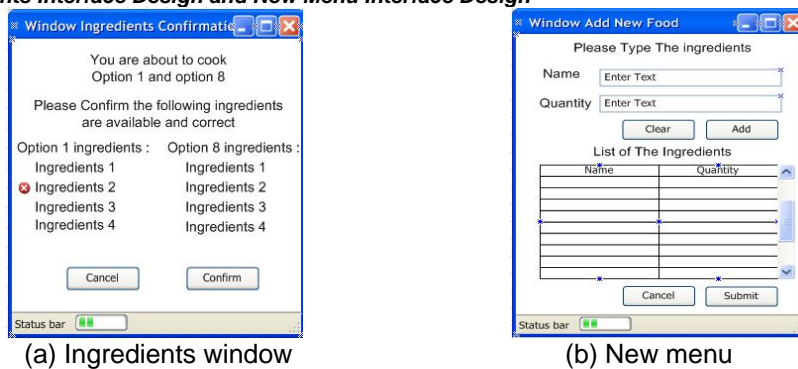


Figure 8. Ingredients and New menu interface

Figure 9 will show which one of the heater entered by the food, which is indicated by a cross and a checklist. Then there is also a heating timer to determine how long the food will be heated.

Heater Window Interface

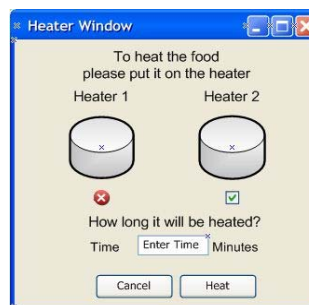


Figure 9. Heater window interface

Figure 10(a) will show information about the application, such as application version, author, license, and a brief description of the applications on this machine. While figure 10(b) shows the help pages of the application. User can select from existing help data and also looking for the necessary assistance in operating the menus on the application machine.

About Window Interface and Help Menu Interface

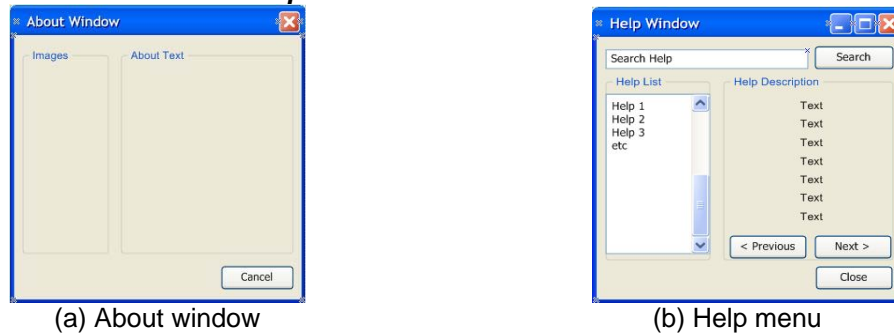


Figure 10. About Window and Help Menu interface

4.4. Robotic Arm Behaviour

In this research planned, this robotic arm can have some behaviors to do cooking based on previous research, where subsumption architecture and motor schema are example of their methods [8].

Robot using proper configuration of behaviors coordination method will accomplish task given by human well. However, in some unpredictable conditions by human designer, robot should has intelligence to make its own decision. One of learning method that suitable for robot application is Reinforcement Learning (RL), a kind of unsupervised learning method which learns from agent's environment [9].

5. Conclusion

The design result is including system design machines, physical machines design, also interface designed that will be embedded in the machine. Later, if this system implemented successfully, this machine will be very helpful in terms of shortening the cooking process. This machine is expected can work automatically so that users do not need to wait from start to finish in cooking process.

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