

INTELLICOOK–THE COOKING ROBOT

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Abstract: By observing day to day life, most of the people still cooking in the kitchen as they have a very busy schedule. It takes lots of time in kitchen to cook food, which makes them fatigued. The proposed model of cooking machine which is fully automated totally based on simple robotic movement. Now the technology has become so vast and now everything is based on the technology in each section. So with the development of this project, it becomes more and more urgent to apply this in all related field. There is much need in food industries, hotels, kitchen, canteens, etc. So we are going to present this automated machine using robotics, which will be very beneficial to everyone.

Keywords -Valves, Induction stove, c- programming, HMI interface, Stirrer, Ingredient Dispenser.

1. INTRODUCTION

In this busy life we constantly give a lot of value to time but later won't save it when it's needed to be. Certain tasks which sound simpler actually consume a lot of time without our knowledge. Cooking is such kind of a task which consumes a lot of time. This generation which generally pre- book all the utilities haven't been used to pre-book to cook at our home without human assistance. This generally solves the problem dealing with such people who consider cooking as a waste of valuable time and often consider it to be a boon as they lack interest to cook or any other problems that they face on a day to day basis. This is not a problem that one of us encountered but it is a problem which is encountered by everyone in the daily lives.

This machine is divided in five sections which are, utensil pick and place, peeling and cutting, induction cooking, addition of ingredients as per requirement, stirring, etc. This machine not only cook food in quantity but also maintains the quality. As in this machine, the input can be provided with HMI. In this recipe can be selected with the proper required quantity of ingredients with the input of number of members. As per the requirement of food we can cook food fast by giving less time delay and also by increasing the power of induction. This system is designed in such a way that time is minimized and ease of work is expected.

2. LITERATURE SURVEY

- Dual Arm Humanoid Cooking Robot [1]

It has the ability to cook dishes with its dual arms in the way of a master chef. It is equipped with a mobile base and stereo vision system, therefore it can navigate around autonomously in a home to help people with other simple housework as well.

- Automatic Cooking Machine [2]

It can put the raw materials into the wok automatically.

It can make the food in the wok heated evenly.

It can finish the basic cooking techniques.

It can clean itself.

- Induction Cooking with Machine Learning [3]

This will increase the heating and energy efficiency by calculating the specific recipient load.

- Mechanical Chef

This will cook food after getting instruction from a mobile application. This robot can handle multiple recipes at the same time without human intervention. This is similar to our project.

- MIT SPICY Kitchen

It features a robot chef that can serve and cook meal with fresh ingredients in five minute. This robot can't be used in home kitchen because of its complexity.

3. OBJECTIVE

Everyone knows that time plays a vital role in their busy life. So most of the people end up spending most of their earnings to get healthy food which is actually not true in today's world. So the main objective is to get healthy food that too homemade without human intervention by making cooking as fully automated. So this project actually does takes the required ingredients and provide us with the freshly prepared homemade food.

Scope/Objective of the Project

- I. Robotic chef for hassle free automated cooking
- II. Time saving and there is no need of Human assistance
- III. Using IOT to smartly control the process of cooking as per needs
- IV. Open source code of recipies can be downloaded from internet directly

3. HARDWARE AND ITS WORKING

A. Stepper motor:

The stepper motors that we use here is 12v and 4.2kg/cm force. This can be used for motion of ingredients wheel and additionally for the ingredients dispenser motion. Stepper motors effectively have multiple toothed electromagnets organized around a central gear-shaped piece of iron. The electromagnets are energized by external driver controller or a microcontroller to form the motor shaft flip, first, one magnet is given power that magnetically attracts the gear's teeth. Once the gear's teeth are aligned to the primary magnet, they're slightly offset from following magnet, this implies that once following magnet is turned on and therefore the 1st is turned off, the gear rotates slightly to align with following one. From there the method is recurrent. Each of these rotations is termed a step, with range number of steps creating a full rotation. This means, the motor is turned by an exact angle.

The circular arrangement of electromagnets is split into teams, every cluster referred to as a section, there's an equal variety of electromagnets per cluster. The amount of teams is chosen by the designer of the stepper motor. The electromagnets of every cluster are interleaved with the electromagnets of different teams to make the same pattern of arrangement.

B. Solenoid valve:

The coil that's used here is 12v and principally used for the flow management of the oil and water for the recipes that are being used.

The principle operating of dominant the flow of liquids or gases during a positive, fully-closed or fully- open mode. They're typically wont replace manual valves. Coil valve operate involves either gap or closing during a valve body, that either permits or prevents flow through the valve. A plunger opens or closes the portal by raising or lowering at intervals a sleeve tube by energizing the coil. Coil valves encompass a coil, plunger and sleeve assembly. In unremarkably closed valves, a plunger come back spring holds the plunger against the portal and prevents flow. Once the coil coil is energized, the resultant force field raises the plunger, facultative flow. Once the coil is energized during a unremarkably open valve, the plunger seals off the portal, that successively prevents flow.

Solenoid valves are the foremost and often used management components in fluidics. they're normally used to shut off, release, dose, distribute or combine fluids. For that reason, they're found in several application areas. Solenoids usually supply quick and safe change, long service life, high dependability, low management power and compact style.

C. A4988 Stepper Motor Drives:

We use the A4988 drives for speed management of the stepper motor and for providing 12V DC offer that isn't attainable by the Arduino alone.

Salient options of A4988 drives:

- Simple step and direction management interface

- Five totally different step resolutions: full-step, half-step, quarter-step, eighth-step, and sixteenth- step
- Adjustable current management permits you to set the most current output with a potentiometer, that permits you to use voltages on top of your stepper motor's rated voltage to attain higher step rates
- Intelligent chopping management that mechanically selects the proper current decay mode (fast decay or slow decay)
- Over-temperature thermal closing, under-voltage opposition, and crossover-current protection
- Short-to-ground and shorted-load protection

D. Relays:

Relays are employed in this model for the management of coil valves by interfacing it with coil . we have a tendency to additionally use a diode IN4007 to get rid of the rear electrical phenomenon that's generated from the provision,which results within the harm of relay and coil.

Relays are switches that open and shut circuits electromechanically or electronically. Relay management one electrical device by gap and shutting contacts in another circuit. As relay diagrams show, once a relay contact is often open (NO), there's Associate in Nursing open contact once the relay isn't energized.

12V DC relay switches are the most effective resolution for full voltage applications, as they permit a coffee current flow circuit to manage a high current flow circuit, sort of a vehicle's horn, headlights, auxiliary lamps, fan motors, blower motors.

E. Induction Stove:

One of the most element needed to cook is that the heat, and therefore the heat is given by the assistance of induction stove. The induction stove used here incorporates a operate to mechanically vary temperature per the food is being ready for various recipes and for various stages i.e for sauting and preparation etc. The on off management is mechanically controlled victimization arduino.

The principle operating of Induction stove is Associate in Nursing induction cooking utensil transfers electricity by induction from a coil of wire into a metal vessel that has got to be magnetism. The coil is mounted beneath the preparation surface, and a high frequency (e.g. twenty four kHz) electricity is seasoned it. this within the coil creates a dynamic force field.The unit will sight whether or not cooking utensil is gift by watching power delivered. like different electrical ceramic preparation surfaces, a most pan size could also be given by the manufacturer, and a minimum size is additionally declared.

The system shuts down the part if a pot isn't gift or not giant enough. If a pan boils dry it will get extraordinarily hot- a thermostat within the surface can close up the ability if it senses warming to stop cooking utensil failures and potential fires.

F. Power Supply:

A direct 240V AC provide can not be given to the motors or magnet, as a result of the 12V DC limitation, because it would possibly injury the elements. therefore the ability provide to the current system ought to be born-again from AC to DC before activity it to elements. this can be the rationale , AC to DC converter device comes into image.

An AC device, AC/DC device, or AC/DC converter could be a style of external power provide usually boxed associate exceedingly in a very {case kind of like an AC plug. Adapters for powered instrumentality additionally begins also} delineate as chargers or recharges (see also battery chargers). AC adapters are used with electrical devices that need power however don't contain internal elements to derive the desired voltage and power from mains power. the interior electronic equipment of associate degree external power provide is extremely kind of like the planning that will be used for a internal provide.

Originally, most AC/DC adapters were linear power provide, containing a transform to convert the mains electricity voltage to a lower voltage, a rectifier to convert it to rhythmical DC, and a filter to swish the rhythmical wave form to DC, with residual ripple variations sufficiently little to go away the steam-powered device unaffected. Size and weight of the device was for the most part determined by the electrical device, that successively was firm by the ability output and mains frequency. Ratings over a couple of watts created the devices large and serious to be physically supported by a wall outlet. The output voltage of those adapters varied with load; for instrumentality requiring a additional stable voltage, linear transformer electronic equipment was additional. Losses within the electrical device and therefore the linear regulator were considerable; potency was comparatively low, and vital power dissipated as heat even once not driving a load.

G .Liquid Bottles:

For storing water and oil, that are the main ingredients for the preparation of any of our dishes. And are distributed with the assistance of 12v solenoid valves time based throughout the preparation of food.

Containers: To store all other raw ingredients and spices except liquids that are dispensed during the preparation of food into the cooking pot or pan as per the desired quantity.

H. Stirrer:

It's used to saute the ingredients present within the pan or pot so the food is cooked evenly without getting stuck to the pan or getting burnt.

I. Cooking Pot:

Oil, water, spices and every other raw food ingredients are collected into it and saute cooked based on time to prepare a dish.

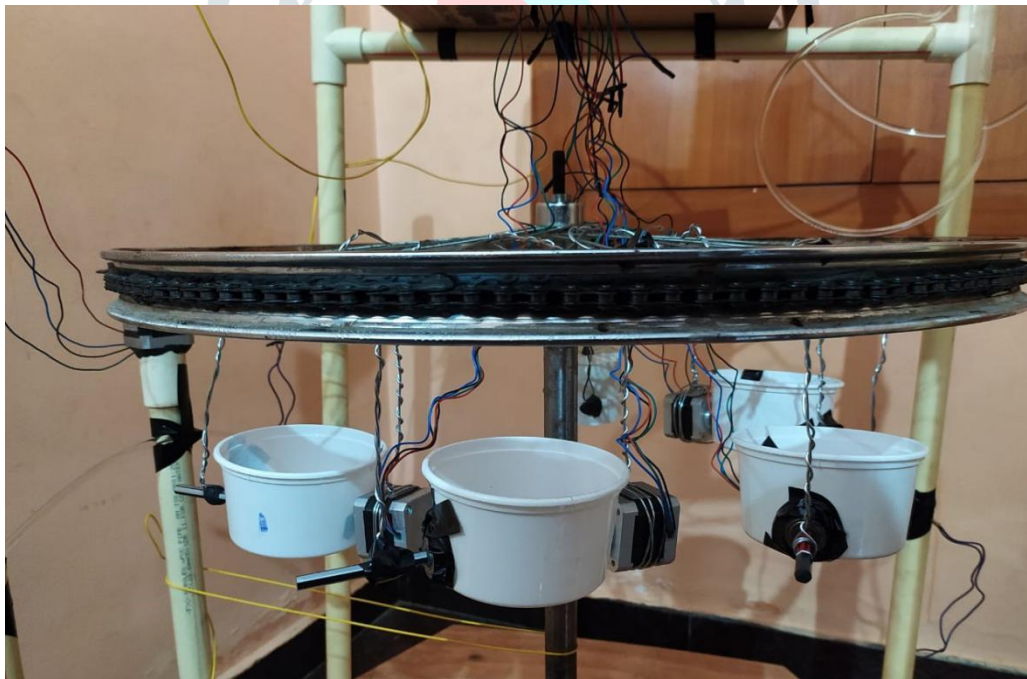
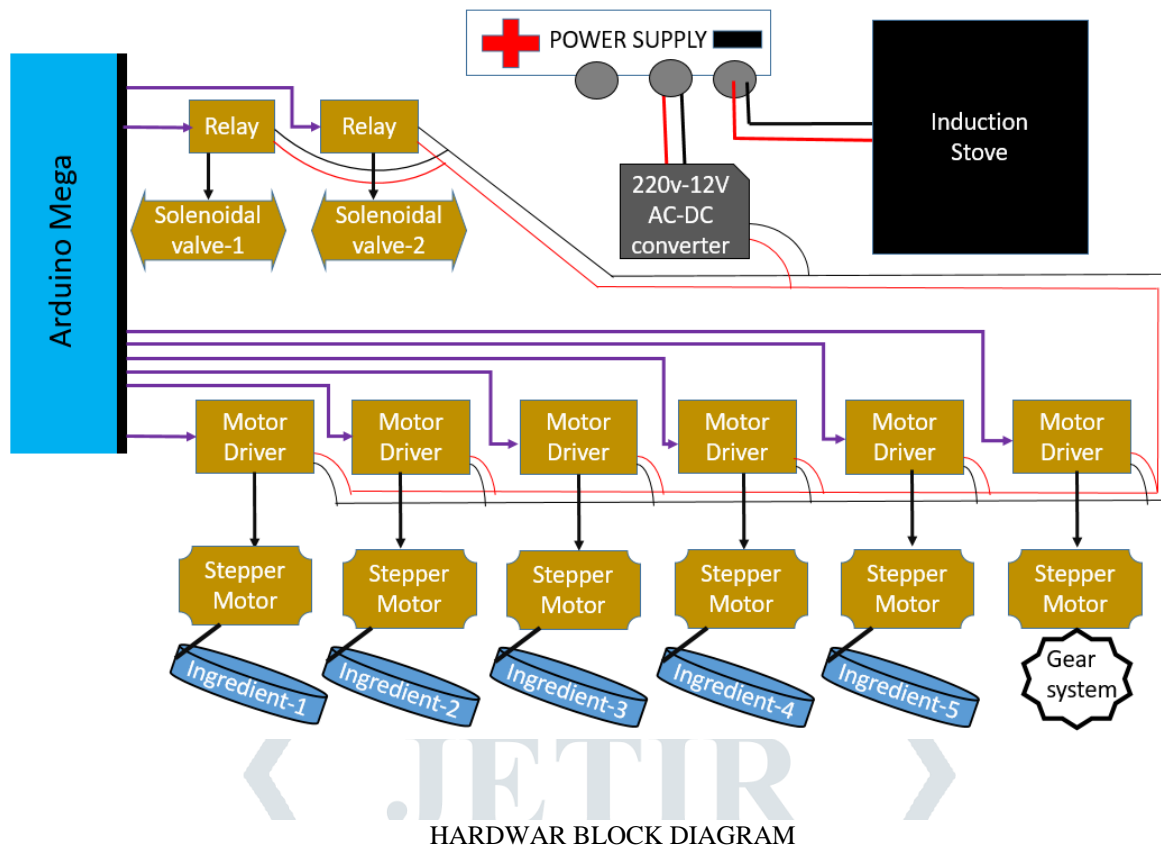


Fig3.1: Gear setup that drives the Ingredient bowls rotated by stepper motor

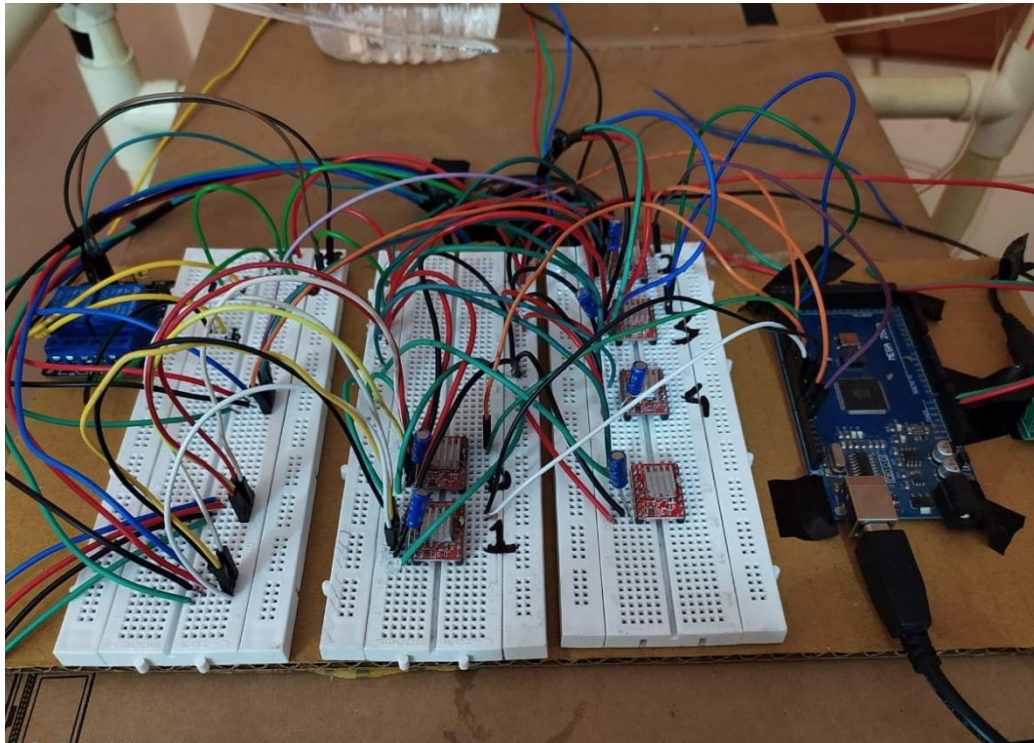


Fig3.2: Circuitry connections include controller Arduino Mega 2560 and driver A4988

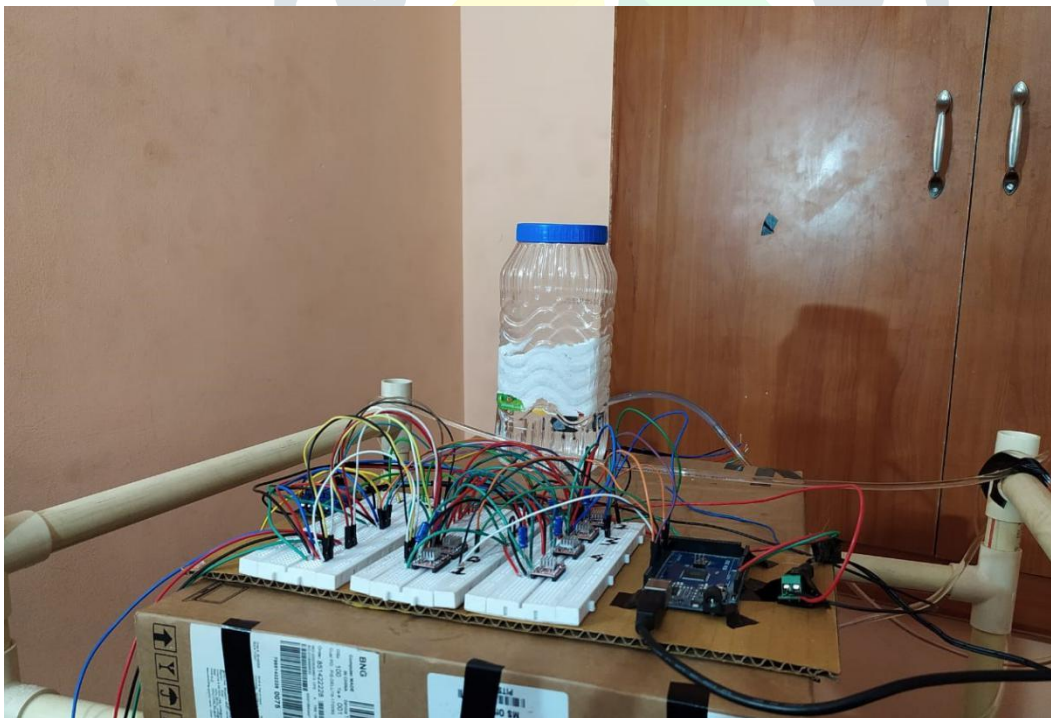


Fig3.3: Controller setup with Liquid bottle dispenser

4. METHODOLOGY

Step 1: **Design.** A Design is ready for concurrent preparation of 2 recipes. A circular wheel structure carrying completely different recipes can dispense ingredient to every stove. the total structure is mounted on a wood base and that we used plastic pipes as pillars. The water for preparation are placed on the highest of all structure.

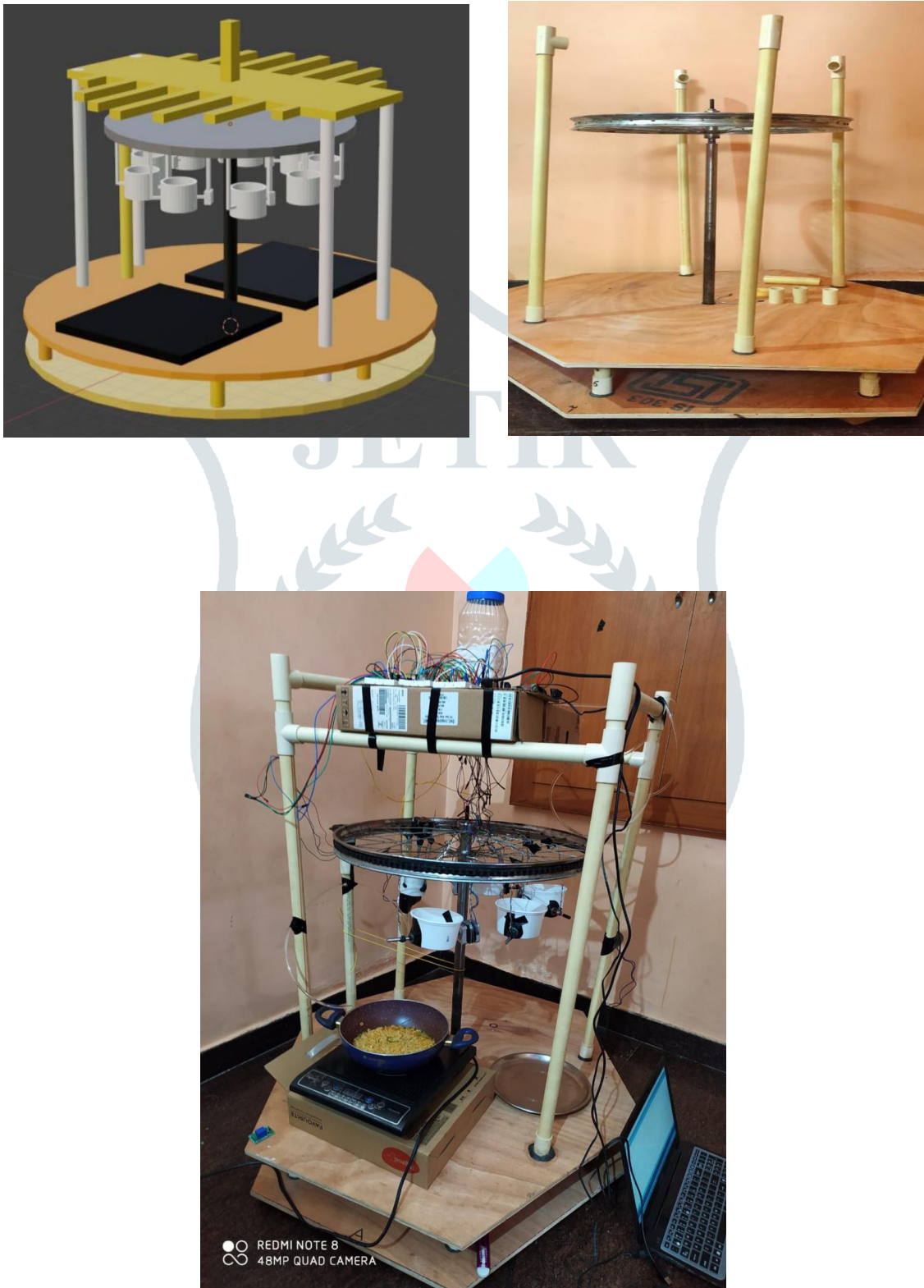


Fig4.1: Proposed Skeletal Design

Step 2: **Assembly and testing elements.** All the hardware elements are assembled and fitted to the wood body and every elements like motors and sensors are tested. conjointly our new style of ingredient dispenser is tested. This single ingredient dispenser will store multiple ingredients and dispense the required one. conjointly we have a tendency to did path preparation in induction to seek out out what quantity time will it go for cook completely different food things



Fig 4.2 Testing the ingredient dispenser and therefore the wheel that carry dispensers.

Step 3: **Calibration of the Robotic arm.** The revolution counters of the stepper motors are updated and a home position is marked and set. in the main 2 elements are graduated, the carrier wheel and therefore the ingredient dispenser. For each elements we have a tendency to marked a purpose|start line|place to begin} and through activity it's set to the current staring point.

Step 4: **Coding .** The recipes are coded mistreatment time based mostly preparation in Arduino code. The approach is once every ingredient is additional, program can build a delay before adding successive ingredient. Programming involves the activity and running of various stepper motor and dominant the temperature in induction stove.

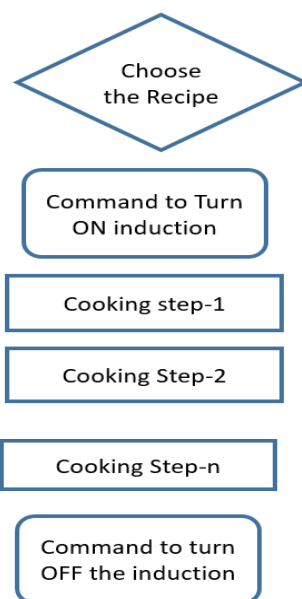


Fig4.3 Basic Algorithm

```

stepper_oneRevolution | Arduino 1.8.9
File Edit Sketch Tools Help

stepper_oneRevolution
const int stepPin = 3;
const int dirPin = 4;

void setup() {
  // Sets the two pins as Outputs
  pinMode(stepPin, OUTPUT);
  pinMode(dirPin, OUTPUT);
}

void loop() {
  digitalWrite(dirPin, LOW );
  for(int x = 0; x < 600; x++)
  {
    digitalWrite(stepPin, HIGH);
    delay(8);
    digitalWrite(stepPin, LOW);
    delay(8);
  }
  delay(10000);
  }
  
```

Fig4.4 Program to rotate the ingredient carrying wheel.

```
solenoid
digitalWrite(dp1,LOW);
}
delay(500);
for(int x=0; x<180;x++)
{digitalWrite(sp1,HIGH);
delay(10);
digitalWrite(sp1,LOW);
delay(10);
digitalWrite(dp1,HIGH);
}
delay(180000);//180000
digitalWrite(dp,HIGH);
for(int x=0; x<250;x++)
{digitalWrite(sp,HIGH);//driver running
delay(10);
digitalWrite(sp,LOW);
delay(10);
digitalWrite(dp,HIGH);
}
digitalWrite(dp2,LOW);
for(int x=0; x<150;x++)
{digitalWrite(sp2,HIGH);
delay(10);
digitalWrite(sp2,LOW);
delay(10);
}
delay(500);
for(int x=0; x<150;x++)
{digitalWrite(sp2,HIGH);
delay(10);
}
}
}
}

Sketch uses 2108 bytes (5%) of program storage space. Maximum is 20480 bytes.
Global variables use 3 bytes (0%) of dynamic memory, leaving 818 bytes for local variables. Maximum is 8192 bytes.
```

Fig4.5 Recipe Program of Veg Maggi

Step 5: **Deploying and testing.** The codes are loaded to the Arduino and are tested by running them.

Step 6: **Modifications** The codes are changed supported the errors and check results.

Step7: **Implementing IOT** The machine is then connected to the Google cloud that successively is accessed by an itinerant.

5. RESULTS AND VERIFICATION

After the development of the machine the next step that was to be done was verification of the machine and it's testing. verification includes cooking a very simple dish and cooking a very complicated dish and getting the decide results in both the test cases.

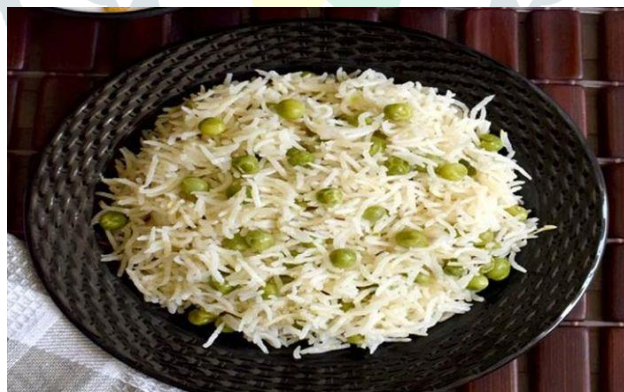


Fig 5.1 resulting of selecting pulav recipie

Intellicook was tested and a time based recipe was prepared the time based recipes where loaded as an Arduino program in the computer or laptop. The ingredients was loaded in the ingredients and the program was executed and the first simple dish that was prepared successfully was boiled rice. The machine encountered some errors like the rotation of stepper motor and it was finally fixed based on the feedback. After lot of rectification the complex meal Vegetable Pulav was prepared.



Fig5.2 Prepared Veg Maggie

7. Advantages and applications

7.1 Application

7.1.1 Household cooking: The machine can be used in household cooking. There will be no necessity of human intervention during the cooking of a meal where the robot will automatically cook the necessary recipe based on the code.

7.1.2 Hotels and Bakeries: The machine can be used in small bakeries and hotels. We can see that many bakeries in hotels lack hygiene. And even the chef availability is hard these days. This Chef reduces all the disadvantages and can help them for a profitable business

7.1.3 College canteen: There will be a lot of tech enthusiast students in a college who be wanting to eat the meal prepared by a robot. This machine can be an attraction as well as a perfect business plan to be executed in the college premises.

7.2 Advantages

7.2.1 Flexibility: It handles wide varieties of recipes that includes North Indian as well as South Indian delicacies. The machine is flexible as it can cook multiple recipes based on the program that is loaded. There can be a change of taste based on the program and the user is given a chance to alter the program.

7.2.2 Time saving: People can spend their valuable time rather than cooking at home for an example early in the morning a breakfast to be prepared is difficult for a late night dinner can be even more complex. This machine is suitable for busy employees.

7.2.3 Cost Effective: The fuel consumption generally during cooking is high when you compare with electrical cooking where we use the induction stove. Added advantage where we don't need to spend money for a chef who prepares our food. This machine can be a one time investment worth a lot of advantages.

7.2.4 Taste Repeatability: Taste is something that is very important but often sometimes it is not maintained, here we use weight-based cooking so that accuracy in the contents and we provide the same taste throughout.

7.2.5 Hygienic Food: A lot of people go in search for food which is having a good taste but forget about the hygiene. Outside food generally has no hygiene here machine can cook hygienic food for the people which will not have sweat unlike the food that is available outside.

8. CONCLUSION

We all want to make save time and make things simple and easy for our daily life and hence to make ourselves productive. Looking at the past years , the growth of Technology and its usage has taken a big step ahead into future and also simultaneously increasing the extensive use of those technology.By this project, we are taking one more step ahead for the betterment of people by saving their cooking time by maintaining the consistency in taste as a major input. This factors are being proved by the number of trails conducted on the machine. This project lets people to cook at their fingertips hassle-free.

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