International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | Impact Factor: 7.488|

||Volume 8, Issue 5, May 2020||

An Automated Serving Robot Based On Artificial Intelligence

S Preethi[1], Rabya Suroor[2], Sahana L[3], Sangeetha U Hottigoudra[4], Amaresha[5]

Final year B.E Students (UG), Department of Information Science & Engineering, The Oxford College of Engineering, Bangalore, India[1,2,3,4]

Assistant Professor, Department of Information Science & Engineering, The Oxford College of Engineering, Bangalore, India[5]

ABSTRACT: As the technology is growing and it is been applied in all the fields and is being used in every aspect of life. As our life becomes busy due to work, we prefer to eat outside in some good restaurant to enjoy the food and to spend quality of time. Along with the good food a good environment is also required as the people demand. A modern restaurant can be equipped with robots or up to date new technologies. In our proposed project work, we are going to design a restaurant that can be controlled and services can be provided automatically using the modern technologies. In today's world the use of robot is going on increasing. Robots are able to carry out every work more effectively and efficiently than a man can do. Hence one of such application of robot could be SERVING ROBOT. There are many areas of research that could be done for a serving robot. We have used image processing to detect the old customer to recognize them automatically. Customers can access the menu sitting at the table itself and can place the order and the food is being served by the robot. In this paper we have try to demonstrate a prototype of Autonomous Serving Robot which will serve the food to the customer. The implementation is done with available resources to reduce the cost of project.

KEYWORDS: Support vector machine, Face recognition, Automatic Food Delivery, Internet of things, Cooking status, Android application.

I. INTRODUCTION

Robot being a great advancement in the field of technology can serve well as a waiter at restaurants and hotels. With their time efficient and dedicated task performance robot can be a perfect solution in catering work. The traditional way of serving comprises of a human waiter, who goes around the customer asking for the order. The main drawback of traditional human waiter is that it is very time consuming and employing a human can cost more as he need to be paid for his service, also when they get sick the work suffers for the owner.

In this paper we have proposed a robotic foodway track which work on the technique of following an assigned coordinated path which is based on 2 dimensional axis that is x and y axis. The robotic tray carry the meal to the tables with their assigned area over a 2 dimensional path separated with x and y coordinate and stop at the point at which table is placed.

An RF module used at the counter section of the restaurant help to guide the robot to the table number at which the meal should be delivered act as an remote control of the waiter robot.
In today's restaurant Digital multi-touch menu cards and other forms of digital facility are replacing old fashioned services like-waiters can take order from customer and serve them. Intelligent Restaurant system delivers almost infinite flexibility in promoting meal and snack options. Intelligent Restaurant system uses technologies innovatively in a modern restaurant such as multi-touch LCD with Arduino mega, RF module, database & line following Robot to enhance quality of services and to enrich customer's dining experience.

The whole system makes use of RF technology. Robot automatically checks the status of the person. It reaches the correct destination and person passes his order to robot. The robot sends the order by wireless technology (RF technology) to counter where a receiver is placed, this receiver receives the signal from the robot (through RF technology) and the person at the counter checks the order, prepare it and put it on the robot and robot again provides proper service to respective person automatically. The robot can take the order from multiple people by reaching near their tables on their call.

The robot can serve to a customer as well as take order from another customer at the same time.

II. PROPOSED SYSTEM

In today's restaurant Digital multi-touch menu cards and other forms of digital facility are replacing old fashioned services like-waiters can take order from customer and serve them. Intelligent Restaurant system delivers almost infinite flexibility in promoting meal and snack options. Intelligent Restaurant system uses technologies innovatively in a modern restaurant such as multi-touch Tab, Robotic module, database & line following Robot to enhance quality of services and to enrich customer's dining experience. A line following robot is designed using sensor operated motors to keep track the line path predetermined for meal serving. Online payment with auto generated bill. In this paper we have made a robot which provides proper service to customer in restaurant. Customers can select the food items from the menu display on the table and place the order. The person at the counter checks the order, prepare it and put it on the robot and robot deliver the food to the respective table. Real time face tracking refers to the task of locating human faces in a video stream and tracking the detected or recognized faces.

Advantages:

- Cost Efficient
- Error free
- Attract customers
- Gain in business

III. METHODOLOGY

◆ MENU MANAGEMENT SYSTEM

The menu management will be authorized by the authorized person from restaurant.

In this they can manage their menu and can hide/delete/add the required item and with pictures of food.

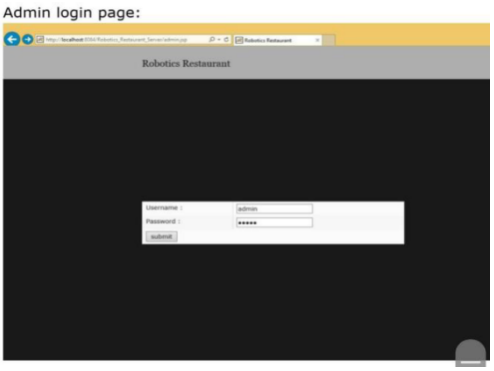

Fig 1: Schematic Design of Admin Login page

Fig 2: Schematic Design of select Menu page

◆ WEB ORDERING SYSTEM

Customers can place their order via their smart phone or smart tap. Customers can select the food items from the menu display on the table and place the order. Customer can order the desired dishes and view them in the cart. After clicking on the button of "order now", it directly flashes on the screen of kitchen side. Then Kitchen's employee will update the food prepare status, after that customer can check the food prepare status.

Fig 3.Android design page

◆ ORDER RETRIEVAL SYSTEM

In this system, restaurant employee will keep track on each and every order receive/serve.

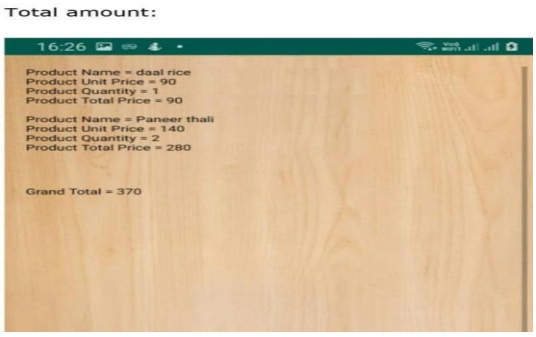

Fig 4. Order Retrieval Page

◆ DELIVER FOOD

The person at the counter checks the order, prepare it and put it on the robot and robot deliver the food to the respective table. Robot will serve the food original position to customer's position.

Fig 5. Deliver Food Page

Fig 6. Update Status Page

FACE RECOGNITION

Real time face tracking refers to the task of locating human faces in a video stream and tracking the detected or recognized faces. After recognized robot can tell to customer like how are you Mr. aa, welcome to our restaurant.

ALGORITHM DESCRIPTION

Face recognition: Real time face tracking refers to the task of locating human faces in a video stream and tracking the detected or recognized faces. After recognized robot can tell to customer like how are you Mr. aa, welcome to our restaurant.

We are using Linear Support Vector Machine (LSVM) in this project. Linear Support Vector Machine (LSVM) are used to train. Certain steps are to be followed in HOG (Histogram of Oriented Gradients). They are:

Extracting HOG descriptors from the positive samples of trained images.

Extracting HOG descriptors from the negative samples that don't contain any objects.

Training LSVM on the samples.

Computing HOG descriptors and applying classifiers on samples which are called as hard negative mining.

Collecting the false negative samples which are found from the hard negative mining stage and sort them.

Testing with dataset.

Finally face recognition is done by using Euclidean distance method.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | Impact Factor: 7.488|

||Volume 8, Issue 5, May 2020||

V. SYSTEM DESIGN AND MODULE DESCRIPTION

◆ INTRODUCTION

A good system design is to organise the program modules in such a way that are easy to develop and change. Structured design techniques help developers to deal with the size and complexity of programs. Analysts create instructions for the developers about how code should be written and how pieces of code should fit together to form a program.

◆ SYSTEM ARCHITECTURE

The architecture of a system describes its major components, their relationships (structures), and how they interact with each other. Software architecture and design includes several contributory factors such as Business strategy, quality attributes, human dynamics, design, and IT environment. We can segregate Software Architecture and Design into two distinct phases: Software Architecture and Software Design. In Architecture, nonfunctional decisions are cast and separated by the functional requirements. In Design, functional requirements are accomplished.

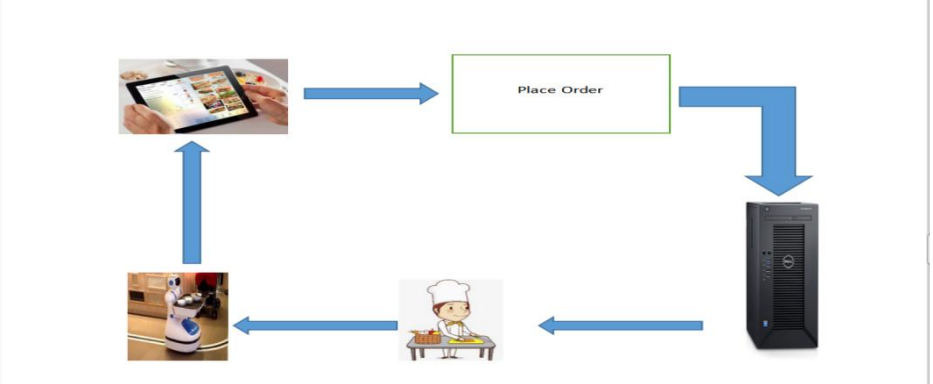

FIG 7. SYSTEM ARCHITECTURE

The Step by step process of the system:

1. Admin can add the menu items and details are saved in the server
2. Customer can check the menu items using the mobile app
3. Customer selects the items and add into the cart
4. Customer can make payment using the mobile app
5. Once order is placed, cook can view the order details and update the status of the cooking process
6. Customer can view the status of the items ordered
7. Once food is prepared, cook updates the status and server sends the instruction to the robot
8. Robot once receives the instruction , moves to the cook to collect
9. Cook places the food items on the tray of the robot and sets the table number
10. Robot than moves to the table to deliver the food
11. Robot once moves to the table trigger the camera and captures the photo
12. The photo is sent to the server for processing
13. Server applies the face recognition algorithm to check the old customer. If old customer is recognized, sends the information to the robot and robot interact with the customer
14. If it's a new customer, server saves the face images in the server.
15. Robot and customer can interact to discuss about the food

VI. DESIGN CONSIDERATION

◆ REQUIREMENT SPECIFICATION

A software requirements specification (SRS) is a document that captures complete description about how the system is expected to perform. It is usually signed off at the end of requirements engineering phase. Framework Requirement Specification (SRS) is a focal report, which outlines the foundation of the item headway handle. It records the

necessities of a structure and in addition has a delineation of its noteworthy highlight. A SRS is basically an affiliation's seeing (in making) of a customer or potential client's edge work necessities and conditions at a particular point in time (for the most part) before any veritable design or change work. It's a two-way insurance approach that ensures that both the client and the affiliation understand exchange's necessities from that perspective at a given point in time.

◆ SOFTWARE DESCRIPTION

ANDROID DESCRIPTION

Android applications are written in the Java programming language. The Android SDK tools compile the code along with any data and resource files into an Android. package, an archive file with an .apk suffix. All the code in a single .apk file is considered to be one application and is the file that Android-powered devices use to install the application.Once installed on a device, each Android application lives in its own security sandboxThe Android operating system, is a multi-user Linux system in which each application is a different user.

ARDUINO IDE

The Arduino IntegratedDevelopment Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards.
The source code for the IDE is released under the GNU General Public License, version 2.
The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures.

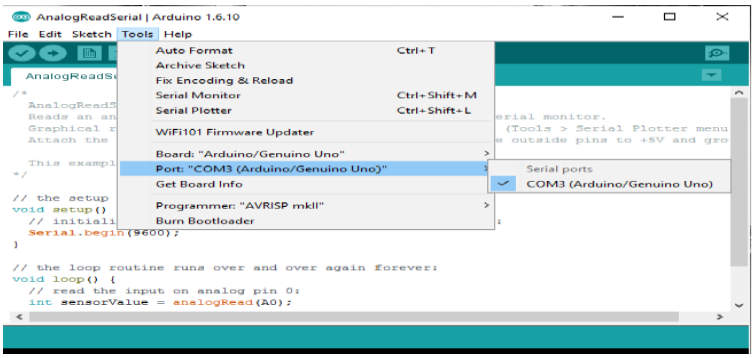

Fig 8.Arduino IDE

NET BEANS IDE

NetBeans IDE is the official IDE for Java 8. With its editors, code analyzers, and converters, you can quickly and smoothly upgrade your applications to use new Java 8 language constructs, such as lambdas, functional operations, and method references.NetBeans IDE provides different views of your data, from multiple project windows to helpful tools for setting up your applications and managing them efficiently, letting you drill down into your data quickly and easily, while giving you versioning tools via Subversion, Mercurial, and Get integration out of the box. When new developers join your project, they can understand the structure of your application because your code is well-organized.

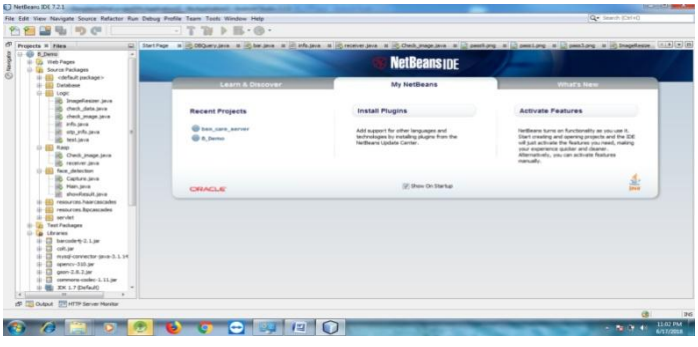

Fig 9.Snap Shot of Net Beans

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | Impact Factor: 7.488|

||Volume 8, Issue 5, May 2020||

MySQL

MySQL ("My Sequel") is (as of 2008) the world's most widely used open source relational database management system (RDBMS) that runs as a server providing multi-user access to a number of databases. The SQL phrase stands for Structured Query Language.
MySQL is a popular choice of database for use in web applications, and is a central component of the widely used LAMP open source web application software stack (and other 'AMP' stacks). LAMP is an acronym for "Linux, Apache, MySQL, Perl/PHP/Python."Free-software-open source projects that require a full-featured database management system often use MySQL.

NAVICAT PREMIUM

Navicat Premium is a multi-connections database administration tool allowing you to connect to MySQL, MariaDB, SQL Server, and SQLite, Oracle and PostgreSQL databases simultaneously within a single application, making database administration to multiple kinds of database so easy.

Navicat Premium combines the functions of other Navicat members and supports most of the features in MySQL, MariaDB, SQL Server, SQLite, Oracle and PostgreSQL including Stored Procedure, Event, Trigger, Function, View, etc.

Navicat Premium enables you to easily and quickly transfer data across various database systems, or to a plain text file with the designated SQL format and encoding.

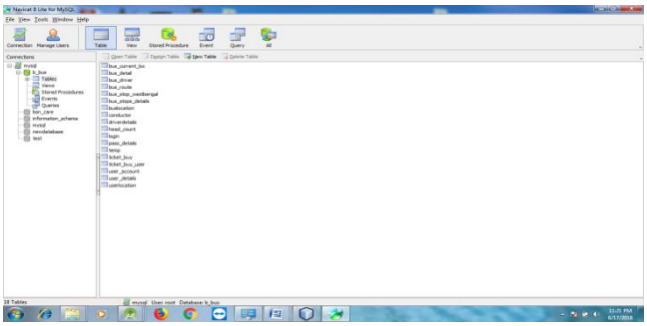

Fig 10.Navicat Lite for MySQL

IV. RESULTS ANALYSIS

The Result of this project is to develop a small scale robot, called the Serving Robot, which can help in the progress in the field of the robotic assistance technologies. A robot that functions as a personal assistant should be able to help in different environments, whether it would be a research lab, a hospital, or even at home. The basic objective of the Serving Robot is to serve the customer effectively. It takes their orders and takes care of transporting food/refreshment to them.
We have used image processing to detect the old customer to recognize them automatically. Customers can access the menu sitting at the table itself and can place the order and the food is being served by the robot. In this paper we have tried to demonstrate a prototype of Autonomous Serving Robot which will enhance the dining experience for the customers. The implementation is done with available resources to reduce the cost of project.

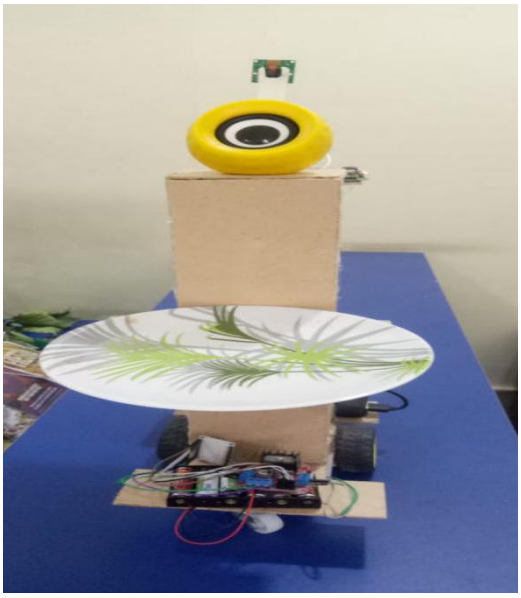

Fig .11(a) Final prototype

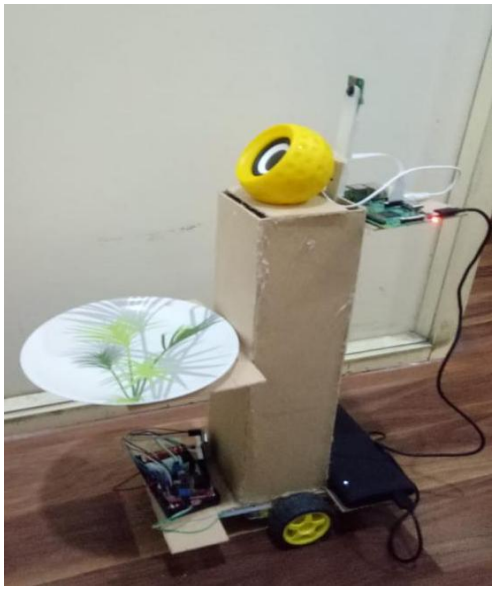

Fig .12(b) Final prototype

V. FUTURE SCOPE OF THIS STUDY

- Cost Efficient
- Error free
- Attract customers
- Gain in business
- The purpose of this project was to create a robotic waiter that would assist restaurant staffs in delivering food.
- Manpower is still an issue in the industry with workers being inefficient and having no-shows.
- They would still need to be trained and paid.
- Reduces customer waiting time.
- One time investment in the system.
- Work can be faster and may reduce the cost of labouring.
- As customers place their own orders, waiter‘s staff numbers can be reduced.
- Applications are performed with precision and high repeatability

VI. CONCLUSION

As we see the robots are increasingly becoming the part of everyday life; the use of Serving Robot can be extend to various functional purposes.
This system allows customers to order food by android app which is wirelessly connected to the kitchen side.
A line following robot is used to carry meal from counter to customer.
Based on our experiences and literature, the restaurant service process will mainly include human service also in the future.
The robotic restaurant system has to fulfill both the needs of the customer and the restaurant’s personnel and it has to provide added value to the restaurant’s business.
The introduced robotic restaurant system Smart menu creates a new way of working because the extensions of the digital menu offer features that help the waiting staff to communicate better with the kitchen.

REFERENCES

[1] P. Lessel, M. Böhmer, A. Kröner and A. Krüger, “User requirements and design guidelines for digital restaurant menus,” Proceedings of the 7th Nordic Conference on Human-Computer Interaction: Making Sense Through Design , pp. 524-533
[2] S. Pieskä, M. Luimula, J. Jauhiainen and V. Spitz, “Social Service Robots in Wellness and Restaurant Applications.,“ Journal of Communication and Computer, Vol 10, No. 1, 2013, pp. 116-123

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | Impact Factor: 7.488|

||Volume 8, Issue 5, May 2020||

[3] T.-H. Tan and C.-S. Chang, "Development and evaluation of an RFID- based e-restaurant system for customer-centric service," Expert Systems with Applications 37 (2010), pp. 6482–6492
[4] P. Baranyi and A. Csapo, "Definition and synergies of cognitive infocommunications," Acta Polytechnica Hungarica 2012; 9(1), pp. 67– 83, 2012.
[5] G. Sallai, "The Cradle of the Cognitive Infocommunications," Acta Polytechnica Hungarica Vol. 9, No. 1, pp. 171-181, 2012.
[6] E.W.T. Ngai, F.F.C. Suk and S.Y.Y. Lo, "Development of an RFID- based sushi management system: The case of a conveyor-belt sushi restaurant," Int. J. Production Economics 112 (2008), pp. 630–645
[7] Y. Qing-xiao, Y. Can, F. Zhuang and Z. Yan-zheng, "Research of the Localization of Restaurant Service Robot," International Journal of Advanced Robotic Systems, Vol. 7, No. 3 (2010), pp. 227-238
[8] E-TableTM, The unique restaurant interactive ordering system Available at: http://www.e-table-interactive.com/, Accessed 3.10.2013