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Amigo: A Smart Helper

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ABSTRACT

Robots have become an integral part of 21st century due to their excessive use in industries, household, hotels and offices. A new concept of using a robot as a friend and personal assistant along with cleaning facility is been introduced here. There are many personal assistants available in the market like Amazon's Alexa, Apple's Siri and for cleaning purpose iRobot's Roomba is there but when we club these two things together in a very cost effective manner so versatility is increased and no need of buying two separate things. It can also act as a friend for alone people as it is intelligent robot to generate the reply from the voice based request received using some AI algorithms and NLP. Basic Objective is to enable machine to perform such a intellectual tasks as decision making, problem solving, perception, understanding, also human communication. It aims to act as a friend who can think rationally and help when needed.

Proposed system will be capable of activities like acting as chat-bot, reading books, playing music, making a call, capturing images. Cleaning is also an important factor for healthy living and hygiene but due to lack of time it is being neglected. Hence we can have this objective as automatic and intelligent automatic floor cleaner having two facilities like vacuum cleaner and floor cleaner with a mop attached to it. There are options available but those are costly to buy so the main aim to build a robot who can act as a friend and cleaner to the user. Also for extensive cleaning we are using intrusion detection system to avoid the robot failure and cover more floor area to clean.

1. Introduction

In the era of technology, humans are planning and inventing such new technologies that would reduce human efforts and improve the living standard. Even the manual work is also possible with the help of robotics and many of the industries are extensively using robot appliances too. The work of personal assistant is also possible with the help of artificial intelligence and robotics called as virtual personal assistant. Physically challenged people and the elderly persons find it difficult to handle new objects with new technology therefore they require assistance for the same. Hence the idea of virtual personal assistant came from here.

Now the aim is to develop a user friendly robotic assistant which is operated with the help of voice commands. Personal assistants, known by various names such as intelligent personal assistants, digital personal assistants, voice assistants or mobile assistants,. This assistant robot can be extensively applied in many fields like chemical industry, homes, manufacturing and also in medical field. This voice based system is intelligent enough which is able to help users to complete their tasks in a more efficient way and remember their to-do list. Voice based assistant is being applied in various devices and applications for providing guidance to users like in smart phones and car for navigation purpose. It has a wide range of applications like in business, education, government, entertainment and healthcare.

Available products in the market for virtual personal assistant are Microsoft's Cortana, Apple's Siri, Amazon Alexa, and Google Assistant. These big giants have used different methodologies for developing the product like Google used Deep Neural Networking concepts to design Google Assistant and Microsoft applied machine learning for developing Microsoft Azure. But the cost is high for people to buy.

Our Proposed system is the great combination of virtual personal assistant and smart floor cleaner. As the available personal assistant have the problem of mobility. Now a days, people are more attracted towards robotic cleaners due to their effectiveness in floor cleaning applications at homes, industries and hospitals. Robotic cleaners are distinguished on their method of cleaning like mopping or vacuum cleaning. Also some products have obstacle detection and avoidance mechanism using the intrusion detection sensors and ultrasonic sensors for the precise measurement of distance between system and intrusion or obstacle. The available products are like iRobot's Roomba which is a smart floor cleaner have advantages like intrusion detection mechanism in it and covers more floor area to clean but not very cost effective so it may appear as a luxury item to buy for common people. The main objective of this work is to provide a substantial solution to the problem of manufacturing robotic cleaner utilizing local resources while keeping it low costs with the help of Raspberry pi 3.

As discussed above, Amigo is the solution for the above two problems for personal assistant and smart cleaner. Amigo in Spanish means a friend whereas it also acts as a helper for mankind. It means a friend will help you when you will require to do so. Amigo can talk with you as a friend, can answer your questions, can read a book for you, also it can follow your commands, it recognizes your voice. It also gives information about the current traffic and current affairs too. Additional

feature here is it can also clean the floor reducing the work. Here the user will totally get a helping friend in case of knowledge, chit-chatting and floor cleaning.

Problem Statement:

Amigo which is the proposed system comprising of two facilities like virtual personal assistant and smart cleaner and designed with the help of system on chip Raspberry pi 3. Hence it reduces the need for buying two gadgets separately so it can termed as the cost effective solution. Amigo is a robot who can think rationally and operates on voice based communication i.e. request and reply. This system uses NLP and speech recognition algorithms from artificial intelligence and generates the reply from DialogflowApi provided by Google.

Basic Idea/Survey:

• Basic idea behind developing a robot is to enable machine to perform such intellectual tasks as decision making, problem solving approach with easy method, perception which consider benefits, understanding the problem, also human – machine communication which allows humans to interact with machines.

- Amigo aims to act as a friend who can think rationally, suggest good things for you, help you whenever you need, act as guide for solving your problems and a good entertainer for you. .
- The voice based communication is needed where one can ask amigo for anything he/she wants to get performed. As its communication so amigo also answers the query through a voice. Here this communication requires text-to-speech and speech-to-text technologies.
- If amigo doesn't have solution or answer for your query it can search it on web for the correct answer, the network connectivity can be provided with the help of Wi-fi or GSM module.
- Even amigo has a battery support so that one can carry it anywhere and amigo will be ready to help you every time. It can also clean the floor when required.

a) Personal Assistant Robot

1. **Technologies Used:** Face Recognition, Autonomous Navigation, Digital Surveillance, Remote Control
2. **Description:** This paper presents the idea of design and implementation prototype of personal assistant robot. It aims to investigate how an intelligent machine interact with a human in a smart way. Technologies like Face Recognition and tracking is used for interaction with master in smart and secure manner.Environment information is essential for robot obstacle avoidance. The robot is equipped with an ultrasonic sensor module to estimate the distance between Personal Assistant Robot and its immediate environment. Autonomous Navigation helps to navigate in unstructured environment.

b) A Voice-Controlled Personal Assistant Robot

1. **Technologies Used:** control over voice, Bluetooth, Android based smart devices
2. **Description:** In this paper control over voice is used for communication between the human and robot. Personal robotic assistants help reducing the manual efforts being put by humans in their day-to-day work. The voice commands are given to the robot using a smart mobile phone which is based on an Android OS based platform. The voice signal is then converted to the text form using an online cloud server, in real time. This text command is sent via Bluetooth network of the smart-phone to the Bluetooth module on the robot. The Bluetooth module on-board the robot receives the text signals and forwards it to the microcontroller on-board the robot's body.

c) Next-Generation of Virtual Personal Assistants (Microsoft Cortana, Apple Siri, Amazon Alexa and Google Home)

1. **Technologies Used:** Multi-modal Dialogue Systems; Gesture Recognition; Image Recognition; Image Recognition.
2. **Description :** In this paper have the multi-modal dialogue systems is used which process two or more combined user input modes, such as speech, image, video, touch, manual gestures, gaze, and head and body movement in order to design the Next Generation of Virtual Personal Assistant model. The new model of Virtual personal Assistant will be used to increase the interaction between humans and the machines by using different technologies, such as gesture recognition, image/video recognition, speech recognition, the vast dialogue and conversational knowledge base, and the general knowledge base. Virtual Personal Assistant system can be used in other different areas of applications, including education assistance, medical assistance, robotics and vehicles, disabilities systems, home automation, and security access control

d) Design and Development of Floor Cleaner Robot (Automatic and Manual)

1. **Technologies Used:** RF Module, LCD, IR sensor
2. **Description:** This paper proposed the system where floor cleaner robot can work in any of two modes "Automatic and Manual". All hardware and software operations are controlled by AT89S52 microcontroller. The developed robot can perform sweeping and mopping task.

RF modules have been used for wireless communication between remote (manual mode) and robot and having range 50m.IR sensors are used to obstacle detection so that robot can avoid the obstacle and navigate to other direction properly . Here robot is with IR sensor for obstacle detection and automatic water sprayer pump. Four motors are used, two for cleaning, one for water pump and one for wheels. Dual relay circuit used to drive the motors one for water pump and another for cleaner. In the manual mode, RF module is used

for transmitting and receiving the information between remote and robot and display the information related to the obstacle detection on LCD.

2. Project Architecture

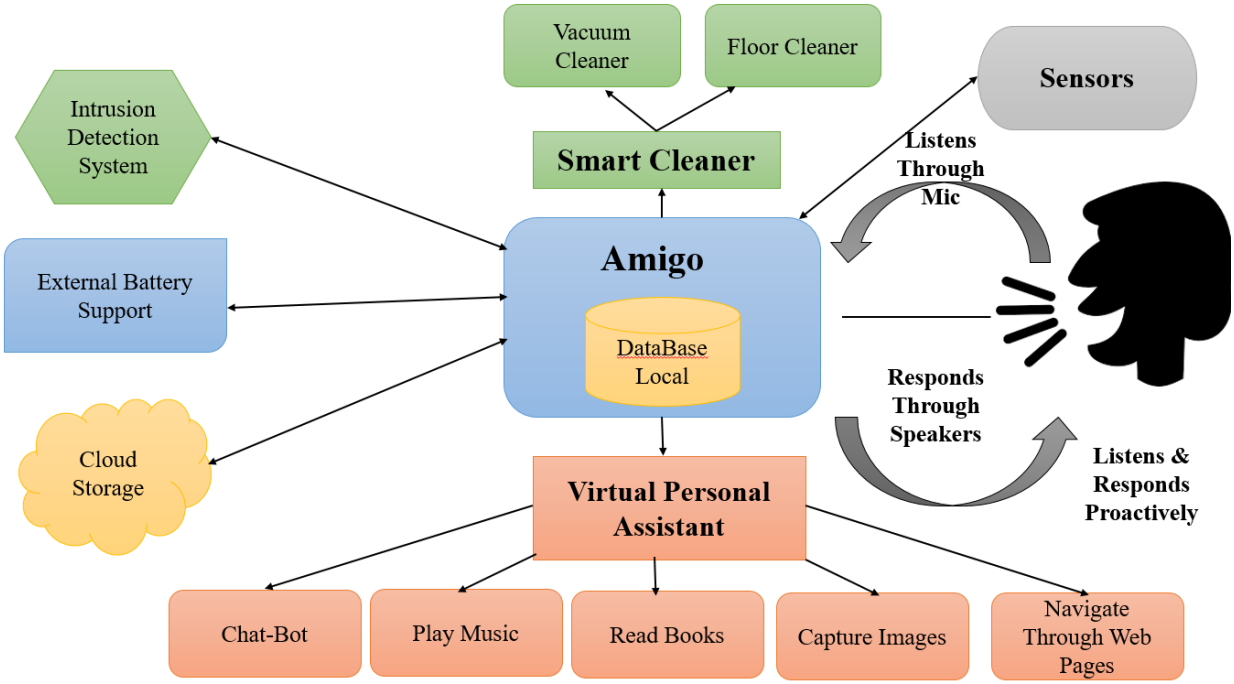

Fig 1: Architecture of Amigo

1. For processing of the whole system Raspberry Pi is used and interfaced with sensors.
2. Transducer mic will be always in the state of sensing the voice input by user then it will listen to the input and send it to speech recognition module and speech recognition module will convert the voice into text form and then analyze whether it belongs to smart cleaning module or personal assistant module.
3. If it belongs to cleaning module or it will compare with the command then start the motor and vacuum cleaner for cleaning purpose also the intrusion detection system will work here to avoid the system hardware loss.
4. If the user input is the request for task related to personal assistant then accordingly it will generate the response using DialogflowApi and will respond using speaker.
5. It will firstly search in its local database for the query if not found then will look for the cloud storage or will navigate the user through web pages.
6. Also the DHT11 sensor will be in active state always for sensing the humidity and temperature of the atmosphere and it will be displayed on the 2 x 16 LCD screen attached to it.

3. Project Approach

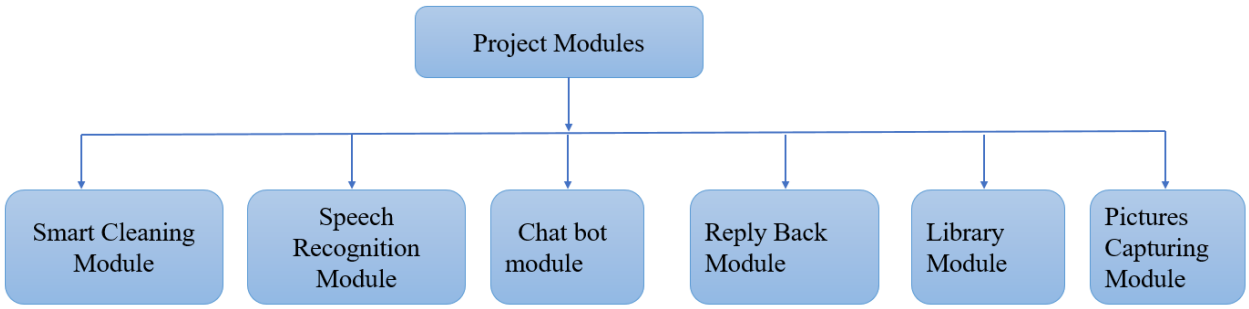

Fig 2: Project Modules

1) **Smart Cleaning Module:** Includes both vacuum cleaner and floor cleaner also detects the intrusion for machine safety. Also turns on the dc motor to clean the floor.

2) **Speech Recognition Module:** Includes the speech recognition that keeps the microphone continuously on for receiving the sound signal at any moment.

3) **Reply Back Module:** Includes the processing and analysis of the received command and matching it with the most appropriate data set and answering back with the help of speakers.
4) **Pictures capturing Module:** Includes the capturing of pictures with the help of camera attached to it.
5) **Library Module:** Includes reading of books which are there on the local storage or on the internet or may be cloud.
6) **Chat-Bot Module:** It includes the communication between Amigo and human owner with the help of dialogflow or Jarvis Amigo will be able to understand what the user wants to say and reply accordingly

Algorithm:

Algorithm for Floor Cleaner:

- Map can be interpreted as 2-d grid, with obstacles as obstructed points in the map.
- Obstacles can be arbitrary, both in quantity and position.
- The algorithm knows nothing about the surrounding environment.
- The robot only provides 3 API: turn_left, turn_right (rotate the looking direction) and move (move ahead 1 point)

Algorithm for Virtual Personal Assistant:

- DialogFlow uses speech recognition algorithm and then for processing of the given command it uses the google speech to text converter to make the command machine understandable.
- Now it analyses the text written command and firstly checks it with the local dataset available & if not then it uses web pages to get the data from navigation.
- Here the interpreted command is being processed and then the most appropriate reply is generated and processed with GTTS and finally the machine starts communicating.

4. Conclusion

Hence this paper describes about voice controlled system comprising an idea of combining a virtual personal assistant and concept of smart cleaner using Raspberry Pi and interfacing it with different sensors like ultrasonic sensor, infrared sensor for developing an intrusion detection system to avoid the system loss which will work in smart cleaner module and for the development of personal assistant a transducer mic is used for sensing the voice input from user and reply generation is done using DialgflowApi which is then given to the user through speakers attached to the system. The available systems in the market are having high costs hence our motive is to provide additional features in low cost and with improved efficiency. So no need to buy two gadgets separately. The paper shows a better and simple approach to provide an overview of design of a simple personal assistant &robotic cleaners using RPI3, sensors and available Apis. Functionalities covered in personal assistant are chat-bot, reading books, playing music, capturing images and navigate through web page to tell information about current affairs. In future we can extend the ability of Amigo clubbing it with emerging trend IOT for converting this personal assistant into home assistant. To develop self-learning ability and self-correction in its functions to avoid human intervention. In future work we can also add healthcare facilities like Heart-beat sensor, BP measurement, simply it will act as a caretaker.

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