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Automation in Cars: Voice Controlled Car Assistant System and Automatic Breaking System – A Review

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Abstract: *The purpose of this project is to build a Voice Controlled Car Assistant System and Automatic Breaking System. A Voice Controlled Car is an advanced robotic vehicle that can be operated by the power of voice commands. It is based on an Arduino microcontroller, motor drivers, and a Bluetooth module. The Arduino hardware is an open-source micro-controller kit used to build digital devices. In our project, we will design the hardware of the Voice Controlled Robotic Car first, then use our previous knowledge of programming to code the entire work. The code will then be simulated on IDE software, and then interfaced with the hardware. An android device with a Bluetooth application is used to control the control unit in coordination with the Bluetooth device, and a Bluetooth module is used to capture and read the voice commands. We choose this project because automation has become a significant part of our lives and also has a broad range of applications in the engineering field. Automation plays a vital role in the development of new technology.*

Keywords: Automation, Arduino, IDE Software, Micro-controller, Car Assistant System, ABS.

I. INTRODUCTION

Today, in the modern age of fast-moving technology, we can accomplish things no one thought we could, but only if we have a platform that automates all our tasks, with ease and comfort. In other words, we need to develop a Personal Assistant capable of brilliant deduction and capable of interacting with the surrounding environment by using human language, one of the materialistic forms of human interaction [1]. Natural language processing artificial intelligence approaches can be used to create a Voice Controlled Car Assistant System that will be able to control IoT applications and answer queries based on web searches [2]. In this way, human interaction with many other sub-systems can be minimized. A successful system will make human life more comfortable by reducing human efforts to perform these tasks manually [5-7]. As part of the system, we will collect voice data, analyze it converts it into text, store and process data, and create a speech based on the text [8]. A major advantage of using the data generated by every phase is that it can be used to analyze patterns and suggest users. These data can even be used by artificial intelligence machines that can learn and understand users later [10, 12].

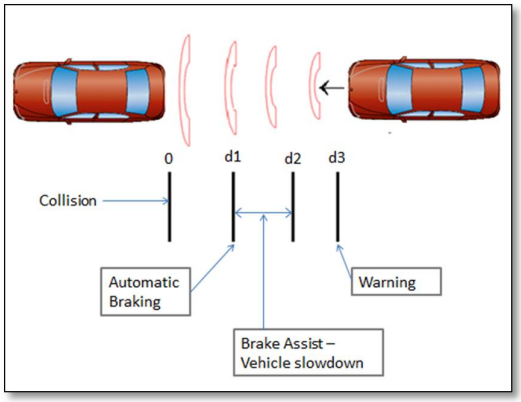

Figure 1: Brake assists vehicle slowdown. [4]

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In Fig 1, Brake assistant vehicle slow down system uses three laser beams level with the rear-view mirror to scan the road for obstacles up to eight meters ahead. The system is capable of preventing collisions if the speed differential between the two vehicles is less than 10 mah. At speeds greater than 10 mah, the system can reduce the severity of impact.

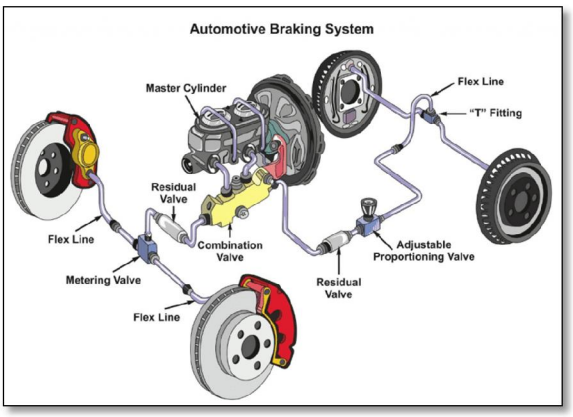

Figure 2: Automotive Breaking System [7]

In fig 2, the Brake system helps to stop vehicles within the smallest possible distance. This is achieved by converting the kinetic energy of the vehicle into heat energy. It also functions on a mechanical device where motion occurs, the brake is applied to stop it within a short period of time.

II. Relevant Articles Selection Criteria

The search engines Google Scholar, Scopus, and Science Direct were used to identify the most important articles relevant to this review. The combination of keywords "automation", "Arduino", "micro-controller", "car assistant system" and "automatic braking system" were used. The last search took place on May 3, 2022. Figure 4, illustrates the process of identifying and selecting relevant research articles.

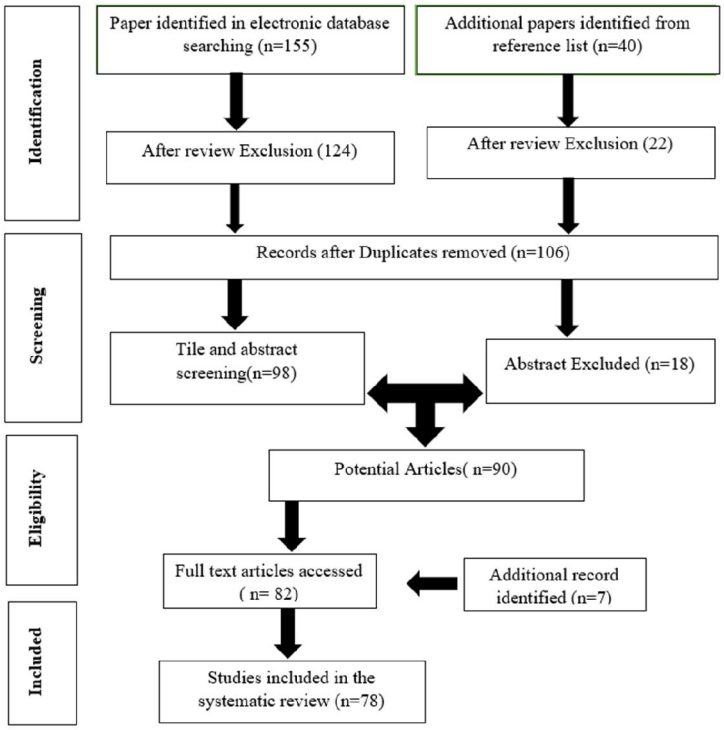

Figure 3: Flow chart for research paper identification and selection strategy.

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The first stage involves searching for articles according to their titles and abstracts. Afterward, existing articles are sorted in order to select the appropriate ones that meet the following three basic criteria, namely: a) the subject should be related to a voice control robot, b) the working of a voice control assistant, and c) the subject should be related to automation. References in the list also led to the identification of additional papers. The final number of papers left in the database is 106 after exclusion from the database. In the second stage, abstracts from these papers are screened, which resulted in 90 potential articles being shortlisted. Then, the articles are read through to determine if they are relevant or not. 78 articles were deemed relevant at the end of the process.

III. Literature Review

Joel Macwan [2] et al have worked on Voice-Controlled Autonomous Vehicle using IoT in that Automation and robotics increase productivity while reducing resource waste. In hazardous locations (ex. factories), they are an easy substitute for humans. Our intention is to expand this further using Machine Learning and Natural Language Processing in the future. Driving the car is as simple as using left, right, forward, back, and stop voice commands. An android application is used to transmit these commands over Bluetooth. For testing and storing voice commands, the control unit and Bluetooth module are combined.

Mandeep Jammigumpula [3] et al have worked on a Voice-Controlled Car using Arduino and Bluetooth module A voice-controlled home assistant robot was designed for this project. Over a wired network, the server receives the order of speech signals. Cars are primarily built using a microcontroller as a platform. The original results of the tests have been evaluated with promising results. The author also examines the prospects for developments in household technologies, schools, vehicle networks, and businesses.

M. Saravanan [4] et al have worked on Arduino Based Voice Controlled Robot Vehicle in this project that can be applied in a variety of fields, including defense, home security, rescue missions, industrial applications, and medical aid. This project uses an android application with a microcontroller to support the voice control of the robot. Voice commands are used to control the robot. As the robot moves, two motors with dc servos are integrated with a microcontroller, while the commands from the application are converted into digital signals by the Bluetooth RF transmitter. The range for the Bluetooth RF transmitter is approximately 100 meters, which is adequate for the robot's movements.

R. Rajalakshmi [6] et al have worked on Voice Controlling Robotic vehicle by Bluetooth Module in this a voice order is sent to the robot using Android's application using the Bluetooth module on the receiving side. The Android application is connected through the Bluetooth module. A mobile application receives voice command signals from the VR module which is present in the mobile and converts the voice signals to digital signals. These digital signals are then sent via Bluetooth to the mobile's database. With a robot, Bluetooth will receive the signals and an Arduino will execute loops. The motor driver, which is made up of the motor connections, will then turn on the motor based on the user's commands.

Shubh Shrivastava [7] et al have worked on a Voice-controlled Robot car using Arduino in this Arduino is open-source hardware (single-board microcontrollers and kits) used for building digital devices. It is based on an Arduino microcontroller, motor drivers, and a Bluetooth module. Through Bluetooth technology, voice commands are effectively transmitted and the desired activities are accomplished. In addition, this task diminishes human efforts at places or under conditions where human involvement is troublesome. Frameworks such as these can be applied in industries, military and defense organizations, examine purposes, and so forth.

Daehee Park [8] et al have worked on A Method for Increasing User Engagement with Voice Assistant System in this Many mobile service providers have introduced voice assistants to provide information such as the schedule for the day, the weather, or tools to control the device to perform a task. Examples of these systems include Bixby from Samsung, Siri from Apple, and Google Assistant from Google. In spite of the fact that voice assistants can perform a variety of different tasks, most users do not know what those tasks are. According to an expert interview analysis of control tasks, the user cannot know all commands for a voice assistant system. Our analysis of buzz data helped us find out what functions could be used and how they might be applied.

Jeong-Yean Yang [10] et al have worked on Affective interaction with a companion robot in an interactive driving assistant system in this Automobile drivers encounter a variety of situations, and robotic systems provide a means for human drivers to understand how changing environments are handled and how robots answer given questions. A car's robotic system and its human driver will need to interact for long periods of time on the basis of accurate situation awareness by the

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robotic assistant and the appropriate ability to discern corresponding reactions. The aim of this paper is to preserve human-robot interaction for driving situations and to anticipate the different types of cognitive situations that can arise and the effects that design can have on the interaction.

Matthew B. Hoy [11] et al have worked on Alexa, Siri, Cortana, and More in this An Introduction to Voice Assistants Voice assistants interpret and respond to human speech using synthesized voices based on interpreting a person's voice. Among the most popular voice assistants, Siri, Alexa, Cortana, and Google Assistant include Apple's Siri, Amazon's Alexa, Microsoft's Cortana, and Google's Assistant. You can use voice commands to control home automation devices, playback media, and manage some basic tasks, like email, task lists, and calendars, with a virtual assistant. Additionally, we will examine some of the privacy and security issues associated with voice assistants, as well as some of the possible future applications. Libraries will need to become familiar with voice assistants as they become more prevalent and possibly consider using them to deliver services and materials.

Malagi, Mazhar Yadav [13] et al have worked on Voice control personal assistant using Raspberry PI in this Artificial Intelligence, Internet of Things, Speech Recognition, Natural Language Processing, and Natural Language Processing are part of it. This model works on user voice input, which is implemented with the Raspberry Pi as the main hardware. Through casual engagement, the user feels that it is his or her own personal assistant, and the device becomes an extension of him or her. A computer network, such as the Internet of Things (IoT), can be used to interact with millions of objects, including services, sensors, actuators, and many other items on the network.

Jehyun Park [14] et al have worked on Driving Assistant Companion with Voice Interface Using Long Short-Term Memory Networks in this with the use of real-time data from range finding sensors, the assistant companion predicts upcoming events on the road and provides narrated information that enhances the learnability and driving performance of the vehicle. We use the online stream of sensory measurements to predict events, instead of priors and maps, as does a conventional navigation system. Our research was carried out using The Open Racing Car Simulator and 16 human drivers to demonstrate the effectiveness of the proposed system.

Pratik Chopra [23] et al have worked on Voice Controlled Robot in this many industries rely on robots for their production. Since robots are operated at a fraction of the cost of human labour, using them is a faster and more efficient solution. In addition, once programmed, robots perform routine tasks with a high level of accuracy that exceeds human operators with decades of experience. Nevertheless, humans are certainly more versatile. Against this basis, voice-activated devices make use of the principle of speech recognition. This technique uses electronic means to convert speech waveforms (into the realization of linguistic expressions) into words (into the best-decorated sequence of linguistic units).

Arnab Bhattacharjee [24] et al have worked on Bangla Voice Controlled Robot for rescue operations in Noisy environment in this they used a feature matching technique based on Vector Quantization to detect Bangla voice commands and detect movement using developed speech detection system. Our system extracted features based on Mel-Frequency Cestrum Coefficients and added a feature extraction mechanism based on Mel-Frequency Cestrum Coefficients to the speech. A rescue robot calibrated to Bangla speaking can be much more effective in disaster management and rescue operation when it is given voiced instructions by a rescuer rather than being static in a location.

Additionally, we have algorithms to create dynamic paths for traversing a path, the capability of properly tracking a specific map in order to reach a point, detection of different gases as well as an obstacle avoidance system, and precise motion control for enhancing the flexibility and dimension of robotic motion. Bangla voice-controlled robotic motion can be employed not only for the automation of industrial processes but can also be viewed as a means of assisting physically challenged people throughout the world in making independent decisions by providing a smooth, easy, and flexible means of self-reliance.

Aditya Chaudhry [25] et al have worked on Arduino Based Voice Controlled Robot in this the paper proposes a system for controlling a robot using a human voice, which describes how such control may be achieved. By using voice commands to control simple robot motions, a voice control robot can be used to control daily tasks. To transmit human commands to the microcontroller, an android application is used. By using the UART protocol, the controller can interface with the Bluetooth module. A speech recognition app is used to process speech received by the android app. Voice is converted to text as text is received by the android app. This text will be further processed by the microcontroller, which will take appropriate action to regulate the robot. Using human voice commands, a robotic car can be directed to move forward, and turn to the left or right.

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Matarneh R. [26] et al have worked on a Comparative review of Speech recognition systems in these different fields of the industry that can also use voice control, including the fatigue level of workers decreases, A faster and more flexible command transmission is achieved, you can use your hands to perform other functions (for example, to record the process flow). The situation that has arisen causes more saturated information to be transmitted, beginning the informed labour activity. This reduces monotony because the operator can monitor the accuracy of the work using his own hearing as result, the workflow becomes more active, with commands being submitted.

Yimin Gao [27] et al have worked on Electronic Braking System of EV and HEV for Automatic Braking System in that optimal braking systems for land vehicles should be capable of stopping the vehicle or reducing its speed as quickly as possible, maintaining the vehicle's direction and recovering kinetic energy to the maximum extent possible. Having the ability to control the front, rear, and antilock braking forces of an EV or HEV electronically has been proposed in this paper, which combines regenerative braking, automatic control of the braking forces of the front and rear wheels, and wheel's antilock function. In case of failure of the electric system, the braking system is capable of functioning as a conventional man-actuated brake system. An analysis of the braking energy that can be potentially recovered in typical driving cycles has been conducted.

I Fetcher [28] et al have worked on Automatic Braking System Control in this vehicle safety and performance can be improved by using computer assisted systems. The braking system is analysed in this paper. Simulation of a car's braking system is the basis of the design exercise, providing an opportunity to evaluate several alternative control strategies. An intelligent control strategy can be applied to solve the problems involved and to capitalize on the opportunities.

Alberto Broggi [29] et al have worked on a new approach to Urban Pedestrian Detection for Automatic Braking System in this a pedestrian detection system is applied to a number of urban scenarios in order to determine potential situations of danger for pedestrians. This paper has developed a new approach to pedestrian detection, which differs from traditional approaches in that it involves locating pedestrians in the immediate vicinity of a vehicle. On the contrary, the approach used here focuses only on pedestrians in critical areas. As a result of the fusion with a vision system, the environment is reconstructed by way of a standard laser scanner, whereas pedestrians are checked by means of a standard laser scanner. A major advantage of this approach is that pedestrian recognition is performed on a limited image area, therefore boosting the system's time-based performance, and that no evaluation of the danger level is required prior to displaying the results to either the driver or an on board computer.

N S Basjaruddin [30] et al have worked on Hardware simulation of Automatic Braking System based on fuzzy logic control in this a vehicle can be blocked by a moving or stationary object. Vehicles could hit people crossing the street. In addition to objects like sidewalks, road separators, power poles, and railroad gates, there are many other objects around roads that can cause accidents if a driver is inattentive. An automatic braking system (ABS) has the capability of assisting the driver in braking automatically. ABS is an important component of Advanced Driver Assistance Systems (ADAS), which assist the driver in navigating the road. In order to reduce traffic accidents caused by human error, this device was developed. By using a remote-control car, we can simulate the implementation of ABS using fuzzy logic based on fuzzy logic.

IV. CONCLUSION

We have determined that based on the literature review and analysis of the existing system, the proposed system not only makes interaction between different systems and modules easier, but also keeps us organized. In the world of automation, there is still plenty of work to be done, but the device's capabilities can be used to build a new generation of voice-controlled devices and bring about the next big step in automation. In this design, great emphasis has been placed on making the system sturdy as well as user-friendly for vehicles with low budgets. Voice-controlled robots will be of interest for many industrial and household applications in the future for automating daily tasks. This project proposes a framework showing how to utilize Bluetooth technology to control a robot. Voice commands associated with the robot can be transmitted through Bluetooth technology effectively. In locations where human interferences are hard to manage, this task lessens the need for human efforts.

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