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COMMAND RELIABLE UNRIVALLED INTELLIGENT SYSTEM (CRUIS) STANDALONE NLP BASED CAR VOICE ASSISTANT

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Abstract : Interacting with the central console or infotainment system, like adjusting the music player, air conditioner, and so on will lead to distraction and may also end up in accidents,so a voice-based control of the entire car would significantly reduce the distraction rate. It's high time a need for an alternative and fairly convenient system to control everything in the car in the simplest way. That's where the proposed hyper-intelligent system which dynamically controls every function of the car, in fact, all of the car functions with just voice commands, comes into play. A high-end Natural processing algorithm powered by deep learning, sequence-to-sequence learning, etc. ensures that no predefined functional commands are set, which means that one can communicate with the AI Voice assistant just like a human increasing the flexibility of control. Multi-lingual support ensures that user-car interaction doesn't get any language hindrance. Apart from the mainstream voice-based assistant the CRUIS artificial intelligent system helps to track down unauthorized access to the car and alerts the car owner before theft or any such instances occur. CRUIS on the other hand powers an SOS alert system that alerts the family members of the car owner in case of any untoward car accident or emergency manual trigger.

Index Terms **- Artificial Intelligence (AI), Natural Language Processing (NLP), Sequence to Sequence Learning (S2S), Recurrent Neural Networking(RNN), Deep Learning , Speech Synthesis**

I. INTRODUCTION

A voice-activated control system (VACS) is a system that uses a microphone to accept verbal commands from the user to control electronic and electric devices such as a TV, projector, computer, and security system. CRUIS (Command Reliable Unrivalled Intelligent System) is a voice-activated car infotainment control system. It is known that controlling the car infotainment system manually could many times lead to hazardous situations due to the driver being distracted. We believe an accurate and very efficient voice-activated control system in the vehicle can be a prominent solution. The speech recognition is fully powered through Google's high-end speech API as well as Google speech-to-text for the text preprocessing and G-Trans API for multi-lingual translation. Speech recognition is an AI-upgraded technology changing human speech from a simple structure completely to a computerized structure. High-level PC programs then utilize advanced speech for additional handling. Speech recognition is a PC getting transcription and is unique concerning NLP. NLP technology assists with understanding the digitized directed speech caught by speech recognition. One technology learns speech information. Different endeavors to appreciate and answer the speech information.Speech recognition programming arrangements fueled by AI advances of NLP and ML get important accommodations in achieving essential questions and basic assignments. These benefits can further develop time use and wipe out numerous unremarkable assignments. Voice enacted innovations improve the client experience, giving fulfilling benefits both at home and work.CRUIS utilizes the AI innovations of NLP, ML, and profound figuring out how to handle voice information input. An information analysis technology isn't pre-modified unequivocally. ML is taken care of huge volumes of information, and utilizing calculations, perceives designs. ML gains information from information. Then a text result or other type of result is given. A portion of the undertakings that NLP uses to separate the digitized language is Part of speech tagging, for example, knowing between a thing or action word concerning a similar word. Word sense disambiguation, recognizes word importance from different potential outcomes. Natural language processing (NLP) alludes to the part of software engineering — and all the more explicitly, the part of man-made consciousness or AI — worried about empowering PCs to comprehend text and verbally expressed words similarly as individuals can.

NLP consolidates computational phonetics — rule-based demonstrating of human language — with factual, AI, and profound learning models. Together, these advancements empower PCs to handle human language as message or voice information and to 'comprehend' its full importance, complete with the speaker or author's goal and feeling.

NLP drives PC programs that decipher text starting with one language and then onto the next, answer spoken orders, and sum up huge volumes of text quickly — even progressively. There's a decent opportunity you've connected with NLP as voice-worked GPS frameworks, computerized collaborators, discourse to-message transcription programming, client care chatbots, and other purchaser comforts. Human language is loaded up with ambiguities that make it staggeringly challenging to compose programming that precisely decides the planned significance of text or voice information. Homonyms, homophones, mockery, maxims, representations, punctuation and utilization of special cases, varieties in sentence structure — these are only a couple of the inconsistencies of human language that take people a very long time to learn, yet that developers should train natural language-driven applications to perceive and see precisely all along if those applications will be helpful.

A few NLP undertakings separate human text and voice information in manners that assist the PC with getting a handle on the thing it's ingesting. Yet, NLP likewise assumes a filling part in big business arrangements that assist with smoothing out business tasks, increment representative efficiency, and work on strategic business processes. Named entity recognition, decides whether a word is an area or a name, for example. Co-reference goal, endeavors to observe subtleties of importance regarding the similar word.Sentiment analysis, endeavors to distinguish emotional sentiments or temperaments. Natural language, changes organized data into human language. Google cloud is CRUIS's main operational basement. Google Cloud's AI instruments are equipped with the best of Google's exploration and technology to assist engineers with zeroing in solely on tackling issues that matter. It constantly updates items so engineers can believe that while utilizing Google's AI apparatuses, utilizing the best that technology brings to the table. Productively Train profound learning and AI models cost-effectively and repeat quicker with superior execution Cloud GPUs and Cloud TPUs .G-Cloud has the efficiency to Build, deploy, and scale CRUIS RNN ML models quicker, with pre-prepared and custom tooling inside a bound together man-made brainpower stage. For making sure that the user-to-car interaction is fully just like two humans talking to each other, apart from NLP structured Recurrent Neural Networking Paradigm is used. Recurrent neural networks (RNNs) are a strong and expressive model for successive information. Start to finish preparing strategies, for example, Connection Temporal Classification makes it conceivable to prepare RNNs for grouping marking issues where the information yield arrangement is obscure. The mix of these techniques with the Long Short-term Memory RNN engineering has demonstrated particularly productive, conveying best in class brings about cursive penmanship recognition. Anyway, their exhibition in speech recognition has so far been frustrating, with improved results returned by profound feed-forward networks. CRUIS consolidates the various degrees of portrayal that have demonstrated so viably in profound networks with the adaptable utilization of long reach setting that engages RNNs. Considering the demand and interest of customers in buying a car with in-car assistance, not only does CRUIS outperform the existing car assistants but is also improved in areas concerning the safety measures

II. RELATED WORKS

2.1 Title: Wireless AI in Smart Car – How Smart A Car Can be? 2020

Authors: Qinyi xu, Beibei Wang, Feng Zhang, Deepika Sai Regani, Fengyu Wang

Billions of smart gadgets connect, communicate, and exchange data with one another in the Internet of Things (IoT) era. Intelligent systems and technologies have been developed to leverage the rich information in collected data, sense what is happening in the surroundings, and finally take actions to enhance their own usefulness as "things" become more connected.

2.2 Title: Sequence-to-Sequence Emotional Voice Conversion With Strength Control, 2021

Authors: Heejin Choi and Minsoo Hann

This research provides an enhanced emotional voice conversion (EVC) system that allows for control of emotional strength and duration. Without duration mapping, EVC approaches generate emotional speech with the same duration as the neutral input speech. In actuality, depending on the emotions, even the same lines might have distinct speeds and rhythms. To address this, the suggested solution employs a sequence-to-sequence network with an attention module, which allows the network to learn which part of the emotional output sequence should receive attention in the neutral input sequence.

2.3 Title: Gated Recurrent Fusion With Joint Training Framework for Robust End-to-End Speech Recognition, 2021

Authors: Cunhang Fan, Jiangyan Yi, Jianhua TaoZhengkun Tian, Bin Liu, Zhengqi Wen

For robust end-to-end automatic speech recognition, the integrated training framework for voice augmentation and recognition approaches has achieved fairly good results (ASR). These methods, on the other hand, simply use the augmented feature as an input to the voice recognition component, which is influenced by the speech distortion issue. This research offers a gated recurrent fusion (GRF) technique with a combined training architecture for robust end-to-end ASR to overcome this problem. To merge the noisy and enriched features dynamically, the GRF algorithm is utilised.

2.4 Title: An Attentive Sequence to Sequence Translator for Localizing Video Clips by Natural Language, 2015

Authors: Ke Ning, Ming Cai, Di Xie, Fei Wu

For localizing video clips using natural language descriptors, offers a novel attentive sequence to sequence translator (ASST). We contribute in two ways. To begin, they suggested an attentive system that synchronizes natural language descriptions with video information. In two directions, a bi-directional Recurrent Neural Network (RNN) parses plain language descriptions. ASST creates a vector sequence representation from a video-description pair. A video frame is represented by each vector, which is conditioned by the description. Not only does the vector sequence representation preserve the temporal connections between the frames, but it also allows for frame-level video language matching.

2.5 U-Compare: A modular NLP workflow construction and evaluation system, 2011

Authors: Y. Kano, M. Miwa, K. B. Cohen, L. E. Hunter, S. Ananiadou, J. Tsujii

Developers of natural language processing (NLP) applications are frequently needed to execute specific operations repeatedly. Workflow comparison and evaluation are two of the most significant of these jobs since they aid in determining

the nature of NLP problems, which is vital from both a scientific and an engineering standpoint. Despite the fact that these operations may possibly be automated, developers choose to do them by hand, creating similar code over and over again.

III. PROPOSED SYSTEM

CRUIS (Command Reliable Unrivaled Intelligent System) is a voice enacted vehicle infotainment control system. It is realized that controlling the vehicle infotainment system physically might numerous multiple times at any point lead to unsafe circumstances because of the driver being diverted. We accept an exact and exceptionally proficient voice enacted control system in the vehicle can be a noticeable arrangement. Utilizing CRUIS the vehicles infotainment system can be controlled through voice with the practicality of communicating in 72 distinct languages which upholds Dynamic Natural language processing. As per a report distributed on January 2020, 63% of drivers think about the presence of an in-vehicle collaborator while looking for a vehicle. Taking into account the interest and premium of clients in purchasing a vehicle with an in-vehicle help, in addition to the fact that CRUIS outperforms the current vehicle collaborators is further developed in regions concerning the well being measures (Accident Alert System). CRUIS has a great deal of fascinating highlights, for instance the driver can screen the whole condition of the vehicle continuously through CRUIS versatile application. It are perpetual to Use CRUIS the potential outcomes.

The presentation of CRUIS (Command Reliable Unrivaled Intelligent System) exceptionally depends on the accuracy of the voice acknowledgment and interpretation. At first a wake word is utilized to enact CRUIS, or should likewise be possible utilizing a voice right hand button on the directing wheel. When CRUIS is initiated, tolerating command from the user will be prepared. At the point when the client provides a voice command to CRIUS, the voice goes through a grouping of sign processing to perceive and grasp the command. In the event that the client selects English, the speech will be perceived and changed over completely to message and the message is then utilized for Natural Language Processing. Be that as it may, in the event that the client selects to communicate in a language other than English, the speech gets perceived and performs speech to message activity utilizing Google Speech API to change over completely to message. The text is then switched over completely to English utilizing Google Translate API. The English text is then utilized for Natural Language Processing. Utilizing Natural Language Processing the command is deciphered and perceived about what activity is required to have been finished. The deciphered command is approved in the data set and the activity is executed. At times, there could be breaks in the voice of the client because of outer factors, for example, ecological clamor, in such case grouping to arrangement learning is applied to the pre - handled text. For example, in the event that the cool is now turned on and the client says "Turn - INTERRUPTED-the climate control system", CRUIS checks for climate control system status and accepts the main conceivable result as "Turn off the air conditioner". This way we can accomplish high accuracy and efficiency.

- Speech Recognition
- Multi Lingual Speech Manipulation
- Speech to Text (English)
- Standalone NLP based Text Processing
- Sequence 2 Sequence Mechanism
- CRUIS Car Controller
- Accident Alert System
- CRUIS App

The **Google Speech API** is utilized to integrate voice input into CRUIS voice system. Speech recognition is gotten to by means of the CRUIS Speech Recognition interface, which gives the capacity to perceive voice setting from a sound info (typically through the gadget's default speech recognition administration I.e. receiver) . For the most part we utilize the connection point's constructor to make another Speech Recognition object, which has various occasion overseers accessible for distinguishing when speech is input through the gadget's mouthpiece. The Speech Grammar interface addresses a holder for a specific arrangement of punctuation that your application ought to perceive. Speech combination is gotten to by means of the Speech Synthesis interface, a message to-speech part that permits projects to peruse out their message content (ordinarily through the gadget's default speech synthesizer.) Different voice types are addressed by Speech Synthesis Voice objects, and various pieces of message that you need to be spoken are addressed by Speech Synthesis Utterance objects

Google Translation API Basic purposes Google's brain machine translation innovation to make an interpretation of texts into more than 100 languages right away. Translation API Advanced offers similar quick, dynamic outcomes got with Basic and extra customization highlights. Customization matters for area and setting explicit terms or expressions, and arranged archive translation. Google Translation API conveys ongoing sound translation straightforwardly to our CRUIS system with upgraded exactness, and worked on reconciliation. we have further developed client experience with low-idleness streaming translation, and scale rapidly with direct internationalization.We've Customized translation administrations to comprehend industry shoptalk, or area explicit terms. We've dealt with to keep up with the specific circumstance and importance in translations of commands and re-headings and so on and fabricated custom translation models utilizing Google's AutoML innovation.

CRUIS Speech to Text and State-of-the-art accuracy Leverages Google's most advanced deep learning neural network algorithms for automatic speech recognition (ASR) through easy model customization experimented with, create, and manage custom resources with the Speech-to-Text UI.

Flexible model deployment to deploy ASR wherever we need it, whether in the cloud with the API or on-premises with Speech-to-Text . Speech adaptation Provide hints to boost the transcription accuracy of rare and domain-specific words or phrases. Use classes to automatically convert spoken numbers into addresses, years, currencies, and more. Domain-specific models chose from a selection of trained models for voice control and video transcription optimized for domain-specific quality requirements. Experiment on speech audio with our easy-to-use user interface. Worked on different configurations to optimize quality and accuracy. CRUIS Maintains control over the entire infrastructure and protected speech data by leveraging Google's speech recognition technology on-premises

Command proccessing include NLP text pre processing as well as Sequence to sequence mechanism utilization through deep learning and Recurrent Neural Networking Mechanism.G-Cloud has the efficiency to Build, convey, and scale CRUIS RNN ML models faster, with pre - ready and custom tooling inside a bound together man-made intellectual prowess stage. For making it sure that the client to vehicle connection is completely very much like two people conversing with one another , aside from NLP organized Recurrent Neural Networking Paradigm is used.Recurrent neural networks (RNNs) are major areas of strength for an expressive model for progressive data. Beginning to end planning methodologies, for instance, Connection Temporal Classification make it possible to get ready RNNs for gathering stamping issues where the data yield course of action is dark. The blend of these methods in with the Long Short-term Memory RNN designing has exhibited especially useful, conveying top tier achieves cursive handwriting acknowledgment. In any case their presentation in discourse acknowledgment has so far been disappointing, with further developed results returned by significant feed forward networks. CRUIS which combine the different levels of depiction that have shown so feasible in significant networks with the versatile usage of long arrive at setting that draws in RNNs. Taking into account the interest and premium of clients in purchasing a vehicle with an in-vehicle help, in addition to the fact that CRUIS outperforms the current vehicle collaborators is further developed in regions concerning the security measures.

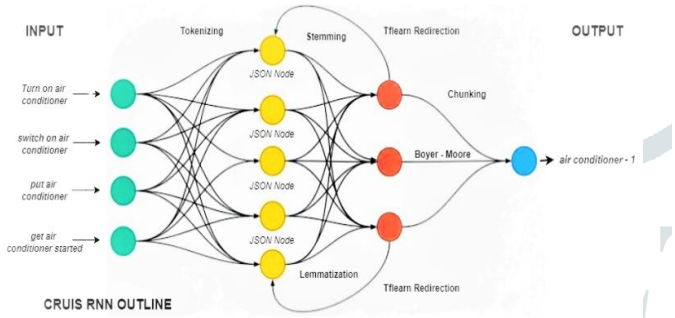


Fig - 1: S2S Model 1

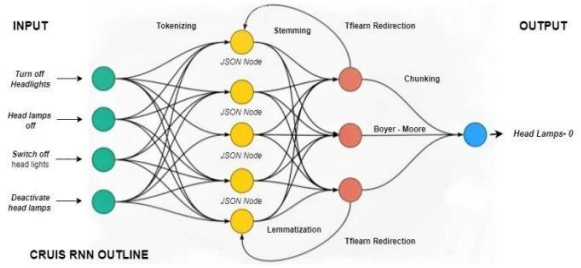


Fig - 2: S2S Model 2

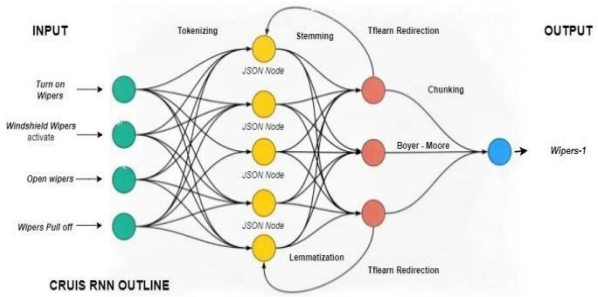


Fig - 3: S2S Model 3

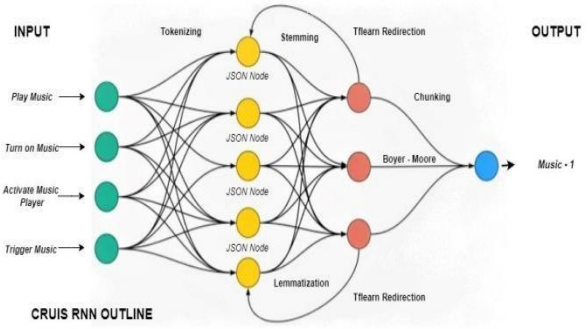


Fig - 4: S2S Model 4

The RNN architecture designed here symbolizes the text pre-processing happening throughout CRUIS.The above four figures describe the internal functioning of the process happening behind CRUIS.Taking a simple example from figure one it deploys and shows how an air conditioner is triggered .There are literally different ways in how we can say to turn on an air conditioner it may be “turn on air conditioner”, “get air conditioner started” and many more. CRUIS algorithm is specifically designed to segregate each and every text through advanced natural language processing technique which helps in analyzing what exactly the command is. To be more brief in detail looking at figure 1,2,3 and 4 four different inputs are taken to symbolize what are the different ways of an user expressing a particular term and the next process is tokenizing and stemming followed by TF learn redirection cause CRUIS algorithm is especially designed to relearn through the user input for better efficiency and better understanding. The end process is Boyer-Moore classification as well as chunking which gives out the exact functionality like for ON the functionality value remains as one and for OFF the functionality value remains at zero .Just for example, from the above figures, it is clear that for turning on air conditioner, “air conditioner” value stands as 1 or playing the music, the “music” value stands as 1 for turning off the wipers , the “wiper” value stays at 0 . Using this zero and one number manipulation each and every functionality through voice based commands for operating the car is triggered in the most efficient and proficient way.

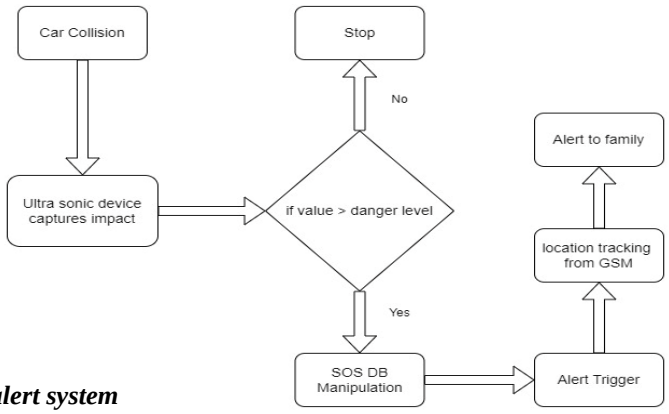


Fig - 5 : Aciident alert system

Apart from voice based commands in operating each and every functionality of the car the CRUIS system is loaded with advanced innovative technology like accident detection system as well as theft detection system .

Accident detection system is basically an alert system to help the people who meet with an accident. The accident rate in India stands very high and the lack of timely help is the reason from major deaths. When a person meets with an accident our CRUIS system helps in alerting each and every people who have linked our CRUIS application by sending the car location of the victim and it helps in ensuring the timely help in rescuing the person from danger . With the help of this system , the number of accident related deaths per year in our country will reduce , which will help in the economical growth of the country as well. Apart from accidents, we designed a **Theft detection system** to deal with theft related issues have been a biggest national issue all over the country. Breaking of glass and breaking of door to penetrate into the car for stealing stuff inside the car or even the car, has been increasing rapidly. When an intruder tries to breach into the car CRUIS system can alert in the application that some mysterious activity is taking place in the car and with the help of this alert the owner of the car can know that something unusual is happening and he can go into that place for the rescue before the theft happens.

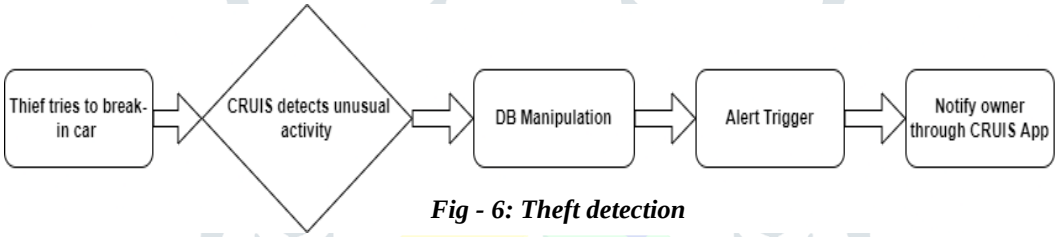


Fig - 6: Theft detection

The figure 5 represents the accident detection system which is basically another system step by step of how their service works and how the family members are alerted in time of danger. The figure 6 represents the theft detection system of how it works as a whole in a system and the functionality POV.

CRUIS Application Apart from the CRUIS central car processor we have designed a specifically unique Android application with optimum ability to perform the same functionalities of voice based control of the entire car. Through CRUIS application the stability can be gained just as the central CRUIS controller and processor. The main need of CRUIS application comes in case of the accident alert system as well as the theft detection system which is a part of CRUIS system Apart from just voice control of the entire system, trip data and statistical data like the speed of the car, the locations traveled by the car, latitude longitude of that car in a particular time point which one wants to know ,the trigger status of the car, the start and off status of the car I.e. the ignition mode of the car, the door lock ON/OFF status of the car , the wipers ON/OFF status and many other dynamic functionality of the car are embedded and can be controlled, analyzed as well as viewed from the CRUIS application. The user interface of cruise application is designed in such a way that it is user-friendly apart from the fact that it also powered by 56 different languages which performs with the same efficiency in voice based control. In case the driver wants the control of the car only from his point of view rather than from other passengers, he can make use of the mobile based voice commands which has a smaller range of circle which limits untoward commands and processing from the other members of the car. This increases the efficiency and performance of the entire system. The process happens entirely through Google cloud and Google server which increases the power of CRUIS by about 200 percentage . The figures 7,8,9 and 10 represents the basic UI and functionality of the car and how it looks like in different statistical point of view .

Fig - 7

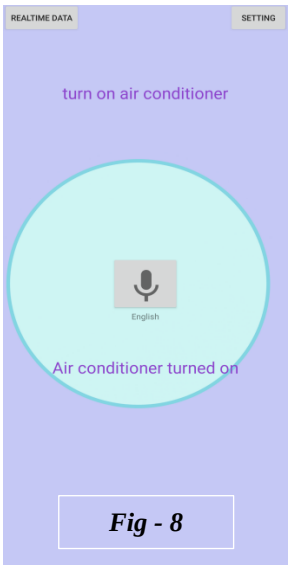


Fig - 8

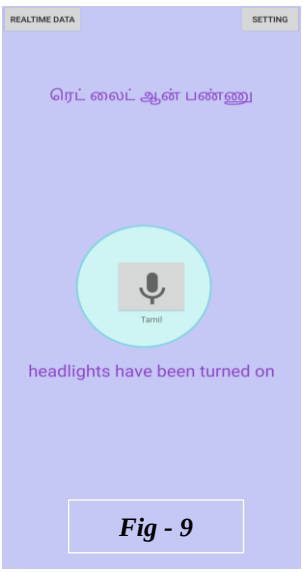


Fig - 9

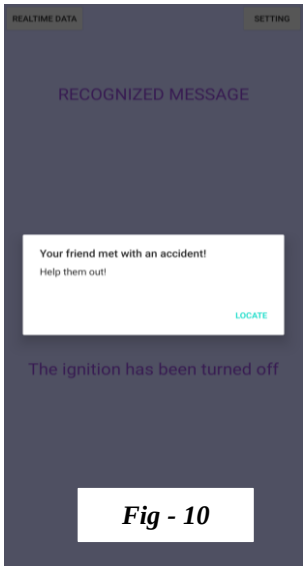


Fig - 10

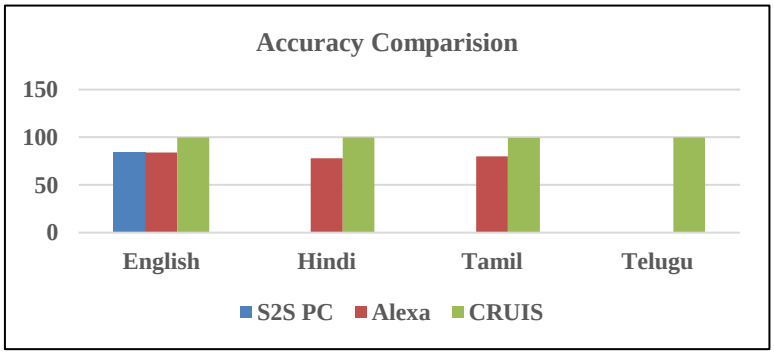
IV. RESULTS AND EXPERIMENTAL DATA

The CRUIS standalone artificial intelligence system which , basically a virtual car assistant has been deployed as a product and as well as tested as and verified .The biggest competitor of CRUIS which is Alexa skill, basically Amazon's trending Voice Assistant which has the capability of understanding eight different languages. The major difference between CRUIS and Alexa is that CRUIS supports 56 different languages with 99%+ accuracy while the average accuracy value for Alexa skill stands at 84% for eight different languages. CRUIS supports sequence sequence learning as well as natural language processing with deep learning methodologies that enhances CRUIS to a large extent. The accident and theft detection have been tested lively and functioning appropriately. Below is the comparison chart between Alexa skill, Perceptual Speech processing, Sequence-2-Sequence voice conversion system and CRUIS with respect to the features which are supported by all of these products. CRUIS remains as the better half of each and every existing combatants which is represented in the chart.

COMPARISION CHART

FEATURES	ALEXA SKILL	PSP	S2S VOICE CONV	CRUIS
Natural Language Processing		✓	✓	✓
50+ Language Support				✓
Accuracy above 80%	✓		✓	✓
Car Trip Data	✓			✓
S2S Learning			✓	✓
Accident/Theft Detection				✓

Starting from natural language processing language support and accuracy, the car trip data, sequence to sequence learning as well as add on extraordinary features like accident and theft detection, CRUIS stands tall above all its counterparts.



The accuracy chart is basically the comparison between S2S Voice Conversion and Alexa Skill with CRUIS which are the biggest competitors. While S2S is limited to only one language and Alexa to 8 different languages , CRUIS stands out with support of 56 different languages with stupefying accuracy, the reason why CRUIS stands tall above all . Bringing to the fact that Alexa skill and S2S VC are limited whereas the sequence to sequence learning powered CRUIS stands tall in the accuracy and each and

every segment. Adam Keras Metric accuracy determination technique is used for gaining the accuracy value in the most proficient way using deep learning NN and machine learning .

ADAM KERAS METRIC ACCURACY DETERMINATION TECHNIQUE

```
| Adam | epoch: 272 | loss: 0.25080 - acc: 0.9889 -- iter:
Training Step: 2714  | total loss: 0.26342 | time: 0.003s
| Adam | epoch: 272 | loss: 0.26342 - acc: 0.9900 -- iter:
Training Step: 2715  | total loss: 0.26207 | time: 0.004s
| Adam | epoch: 272 | loss: 0.26207 - acc: 0.9910 -- iter:
Training Step: 2716  | total loss: 0.26266 | time: 0.004s
| Adam | epoch: 272 | loss: 0.26266 - acc: 0.9919 -- iter:
Training Step: 2717  | total loss: 0.28918 | time: 0.005s
| Adam | epoch: 272 | loss: 0.28918 - acc: 0.9934 -- iter:
Training Step: 2718  | total loss: 0.31216 | time: 0.006s
| Adam | epoch: 272 | loss: 0.31216 - acc: 0.9934 -- iter:
Training Step: 2719  | total loss: 0.29853 | time: 0.007s
| Adam | epoch: 272 | loss: 0.29853 - acc: 0.9941 -- iter:
Training Step: 2720  | total loss: 0.30015 | time: 0.008s
| Adam | epoch: 272 | loss: 0.30015 - acc: 0.9947 -- iter:
```

V. CONCLUSION

CRUIS being able to control the functionalities of the car by only using their voice is a dream for many car owners on a budget. We implemented and made it possible to control the car infotainment by voice. The computational models, which were implemented in this project, were chosen after extensive research, and the successful testing results confirm that the choices made by the researcher were reliable. This system was tested under very robust conditions in this experimental study and it is envisaged that real-world performance will be far more accurate. We were able to help the user interact with CRUIS just like the user would interact with another human. The voice recognition for 56 different languages was put to the test under robust conditions and the results we received were quite promising. The accuracy for voice recognition results with 99% accuracy which we determined using Adam Keras Metric Accuracy determination technique. All implemented systems displayed commendable results and reflect well on the deformable template and Principal Component Analysis strategies. By analyzing the accuracy, effectiveness and stability of CRUIS, we believe that CRUIS will revolutionize the automotive industry.

VI. FUTURE WORKS

The future work include making provision to support more wide range languages in CRUIS and make it more globally suitable and expandable as well as increasing the count of attributes in CRUIS (Currently 75 attributes).Secondary main uphill and upcoming work would be bringing accident detection system in bikes.

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