

A Novel Method For Smart Interactive Mirror Based On Artificial Intelligence

Parag Sohoni, Bhawana Pillai, Sushila Sonare

Abstract: Artificial intelligence (AI) is one of the most intriguing research fields in computer science which is aimed at imparting intelligence to machines. AI has a wide range of applications from diagnosis of medical ailments to financial market analysis. AI also has a huge role in augmenting and amplifying our capabilities. In today's demanding fast pace of life, we need to have information on the go. With everything getting smart and interactive, exchange of knowledge and information gets easier. But a lot of our time is whiled away doing the general chores and getting ready. Imagine a scenario when you come in front of your mirror to get dressed and your own personal assistant, powered with AI, is at your disposal for a series of tasks and updates that you demand from it, like user customized news feeds, weather updates, and a plethora of services on the go. Smart Mirror aims to be your interactive assistant. It follows service-oriented architecture and uses Artificial Intelligence, Natural Language Understanding, Speech Recognition and Speech to Text Conversion. Smart Mirror is an approach to minimize and reduce human effort and intervention, that is, it gives an insight into the ever-expanding world of Artificial Intelligence and interaction as is.

Keywords: Artificial Intelligence, Interactive, Speech Recognition, Smart Mirror

1 INTRODUCTION

NOT a day goes by when some of us don't ponder as to how Artificial Intelligence will one day take over the reigns on this world and overpower humanity. More and more products nowadays are becoming smart and a mirror is an accessory that has recently caught the trend. [1] But, do we actually understand Artificial Intelligence? A very few of us do. However, we are surrounded by technology these days most of which comes equipped with artificial intelligence. To put it into simpler terms, Artificial Intelligence (AI) is the intelligence displayed by machines in contrast to the Natural Intelligence displayed by humans like learning, reasoning and self-correction. We know that in today's fast and busy lifestyle, ease of access and availability of information is valued more than probably any other resource out there. Keeping this in mind, we tried building a mirror, intelligent enough to provide information regarding general topics and also having the ability to interact with the user, answering general queries. The main hardware chip that is used is Raspberry Pi and the operating system is Raspbian OS which is a derivative of Debian. [2] Our smart mirror consists of a display module, a Raspberry Pi, a speaker and a code running in the background providing aid to the user continuously. [4] The Smart Mirror provides user customized newsfeed, weather updates, and a plethora of services on the go. Using AI, we have created a device which, acts as a "Smart Mirror" by providing customizable information on the display. acts as a conventional mirror while also superimposing informational data, which can be customized by the user. allows for touch free user interaction with inbuilt voice recognition feature. provides the users with the ability to create a profile and customize the visual interface to display what specific data feeds they want.

Time is precious and precious things need to be saved and taken care of. With Mirr-Active, you will be able to get updated about various topics of your interest on the go, that is, while dressing up or grooming yourself. You would not need to devote time specifically for the purpose of getting yourself up to date with what concerns you. The smart mirror possesses the following features: Easily Accessible Data: Data regarding news and weather and general questions are easily accessible and is just a question or command away. Control System: Your voice is your control system. You will be able to ask questions to the mirror verbally and get answers for the same. Hands Free Control: The main purpose of the mirror is specifically aimed at providing hands free experience along with a good interactive session during the time you spent grooming yourself. Thus, Smart Mirror provides a completely hands-free control. The smart mirror is capable of giving a good user experience because it incorporates the following attributes in it: Interactive: The proposed "Smart Mirror" can interact with the user giving the user information and updates on some topics that are asked for. Customizable: The feeds and updates given by the mirror are completely customizable and depend upon the person standing in front of the mirror. Multitasking: The artificial intelligence inbuilt in the "Smart Mirror" helps it to perform various operations such as providing updates and feeds on general topic along with doing the conventional job of a normal mirror. User Friendly: The application is user friendly as it enables user to operate the mirror just like another computer or any other smart device. State of the Art: This futuristic approach of the proposed "Smart Mirror" helps to contribute towards modernization and the concept of a "Smart Homes".

2 REVIEW OF LITERATURE

Existing Systems Many AI Enabled assistants are present currently and have been developed by big companies such as Google's Assistant, Amazon's Alexa and Apple's Siri. But none of them gives you the functionality to inform you while you are getting ready for work or grooming yourself. Also, it might happen that what these assistants say might sometimes be not understood by some people. Smart Mirror allows you to do just the same along with displaying the text on the mirror so that the user can read it if she/he is unable to understand what is being said by the assistant.

- Parag Sohoni: Assistant professor, Department of CSE LNCTS Bhopal, India. Email: Parag.sohoni@gmail.com
- Bhawana Pillai: Assistant professor, Department of CSE LNCTS, Bhopal, India. Email: bhawanapillai@gmail.com
- Sushila Sonare: Assistant professor, Department of CSE LNCTS, Bhopal, India. Email:

Overview on AI Projects The major objectives of AI projects include the application of expert knowledge, environmental view, manipulation of physical objects and natural language processing. The approaches used to accomplish these goals include computational intelligence, machine learning, statistical methods and traditional symbolism. The tools that computer scientists use to implement these approaches include mathematical logic, search optimization and other methods based in a particular field of study. In addition to computer science, AI draws on other fields such as linguistics, mathematics, neuroscience, philosophy and psychology. AI project is based on the concept that human intelligence can be described sufficiently precisely that a machine can simulate it. The question "What is artificial intelligence?" raises strong debate on the nature of the human mind and the ethics of endowing machines with human-like intelligence, which have been explored since antiquity. The algorithms for difficult problems require great computing resources, especially processing speed and memory. These requirements typically experience exponential growth, meaning, that many AI problems require more computing resources than are currently available. Increasing the efficiency of algorithms is, therefore, a high priority in AI enabled devices. Many problems that AI machines are expected to solve require extensive knowledge of the physical world, making knowledge representation an essential element of AI enabled devices.

3. DESIGN

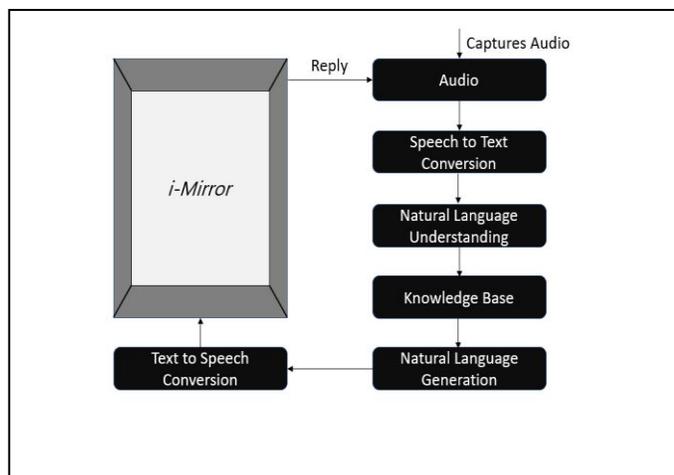


Fig. 1. Design Phase

4. TECHNOLOGIES USED

Raspberry Pi We have used Raspberry Pi 3 Model B in this project. Raspberry Pi is a microcontroller and a series of small computer chips that was developed in the United Kingdom to facilitate programming and aid children in programming. We have used Raspberry Pi, since, the Raspbian OS is a derivative of Debian OS making a combination of unique file structure and ease of handling. **Python** Python is a high-level programming language used for general purpose programming. It features a dynamic file system and automatic memory management along with support for multiple programming paradigms, including object oriented, imperative, functional and procedural and

has a large and comprehensive standard library. **Google Speech API** There are a variety of scenarios where in humans want hands free interaction with their devices such as driving, cooking and many other tasks. At these times, Automatic Speech Recognition (ASR) becomes useful and increasingly relevant because the use of voice is the most natural and convenient way of human-device interaction. ASR is developed and deployed at Google, that allows users to select arbitrary combinations of spoken languages. But, every coin has two sides. Though ASR provides many advantages, it comes as a disadvantage for those who are multilingual, since, many ASR Systems can speak only a single pre-set language according to several sources. [5][6][7] Naturally, research has been going on to overcome this disadvantage and indeed a certain technique that has been thought of is to train a universal speech module capable of recognizing multiple languages. Efforts as mentioned in [8][9] [10]. Google Speech API provides and understands over 80 different accents all across the globe and provides the developers with the ability to convert speech to text and text to speech with much ease. All the data is stored in the Google Cloud Platform. Wit AI Wit AI makes it easy for developers to build applications and devices that you can talk or text to. It empowers developers with an open and extensible natural language platform. Wit AI learns human language from every interaction and leverages the community: what's learned is shared across developers. Wit AI API is completely free for public and private instances with no limitations on request rate. It provides a nice combination of both voice recognition and machine learning for developers. Wit AI has two elements to it that you set within your application– 1) Intents. 2) Entities. Actions are separated to use as some combined operations. It has pre-build entities like temperature, number, URLs, emails, etc. It does not have an interaction module to directly communicate with other messenger APIs (like Facebook Messenger), but, it has web service API to hook services. Wit AI API is available for developers to use with iOS, Android, Windows Phone, Raspberry Pi, Python, C and Rust. It also has JavaScript plugin for front-end developers. **Dark Sky API** Dark Sky is a service that provides an API key which allows us to get information regarding weather, temperature, humidity wind speed along with a detailed analysis of each and every one of them.

5 SYSTEM DESCRIPTION

5.1 Working of Device

Upon the booting of the mirror, it gains the ability to provide an insight to the questions asked by the user and give relevant responses based on the query in a timely manner. So basically, the mirror, when it opens, is like an intelligent interactive center to help people. [3] For the Smart Mirror to start, two directories, BasicMirror and iMirror, which have been created, are used. 'npm start' command runs or executes the file in the BasicMirror directory with an extension json. Then in the iMirror directory, we activate the virtual environment created for python using "source virtualenv/bin/activate". After the activation of the virtual environment, we execute the main python file, after the 'npm start' command has been executed. When this file is executed, it runs a pre-set audio lines and a gif of a face is displayed as a welcome page for every user. The AI part

begins when the launch phrase. 'Ok Mirror', is said by the user which in turn activates the Mirr-Active. The user can ask any query to the mirror after activating it using the launch phrase. We have created a knowledge base containing queries regarding holidays, user status, insult, greeting, user name, maps, weather, news, personal status, meaning of life, appearance, joke, and appreciation. These fields are called as Trait Values. Whenever a user asks a query on the above-mentioned topics, the query is taken as input in audio form. That audio, is then, recognized and broken down using Google Speech Recognition (GSR). The GSR converts the audio into text, which is then passed to Wit AI. Wit AI deals with machine reading comprehension and divides the input query into Intents like weather, holidays, etc. and Entities like today, next few, etc. The answer to the query is then fetched from the knowledge base where the file knowledge.py is used. When the AI has a definitive answer for the input query, it is computed and constructed into a grammatically correct sentence. This job is done by Natural Language Generation which creates sentences like "You look beautiful today!". A file for natural language generation has all the components to create sentences as a response to users and they are used to create its replies dynamically. This data or sentence is then converted into speech using Google's text-to-speech converter. The output is then played for the user using speakers. This is how one cycle of question and answer takes place. This procedure is repeated till the time user wants to keep asking questions.

5.2 Flow of Process

Google Speech Recognition Speech-to-Text allows developers to convert audio to text by applying strong neural network models in an easy to use API. The API recognizes the language and variants, to support your global user base, and then passes the data to Wit AI which is the NLU of our project. It processes real-time streaming audio, using Google's machine learning technology. Natural Language Understanding (NLU) NLU is a subtopic of natural language processing in artificial intelligence that deals with machine reading comprehension. Its applications are in the field of news-gathering, text categorization, voice-activation, archiving, and large-scale content-analysis, hence, it is used by the Mirr-Active. Wit is a natural language interface for applications deserving of turning sentences into structured information. Wit AI extracts the intents and entities from the text passed to it by the GSR. For example, 'holiday' would be intent and 'next few' would be the entity for that intent in the sentence "Give me list of next few holidays". Wit AI uses or searches the knowledge base for answers after extracting intents from the text which was input as audio. Knowledge Base It is the job of the knowledge base which is included in the knowledge.py file of our interface to search for the answer of the query asked to it by the user after NLU has broken it down into intents and entities. Knowledge.py file makes use of various links and keys in order to fetch the right answer of the user's question. For example, it uses darksky.net key in order to get the weather-related information. The correct answer to the query is then forwarded to the NLG in order to give a correct output. Natural Language Generation (NLG) Natural language generation (NLG) is the natural language processing task of generating natural language from a

machine representation system such as a knowledge base or a logical form. It can be said that an NLG system is similar to a translator that transcribes data into a natural language representation. The nlg.py file is the vocabulary or grammar part of the interface. It contains all the language related information like greetings, adverbs, salutations, etc. It forms a grammatically correct sentence using the information passed to it by the knowledge base, that is, it forms sentence including the answer to the query in a form to be understood by the user.

6. APPLICATIONS

Receptionist This application provides flexibility to the user to ask a query from the list of intents and eliminates the requirements of a human. Where only answering is required Toll Free Calls / Call Center Conventional Mirror

7 IMPLEMENTATIONS

When the mirror starts, it continuously listens for the launch phrase in the surrounding ("OK Mirror!" in our case). As soon as the launch phrase is detected, the module does two things simultaneously Cancels out the surrounding noise. Starts recording what is being said by the user. The user query is then converted into text by the Speech Module using Google Speech API. This is done because, text is processed faster as compared to audio. So, for better processing and fast responses, the speech is converted into text.. This query, which has been converted into text is split into two things – intents and entities. This is done using Wit AI. Consider the following example – "What is the weather today?". This sentence is classified as intent = weather and entity = today. This is then parsed and the answer is retrieved from the internet using a GET Request. The answer is returned as a JSON object. This JSON object is then synthesized into proper sentences that are human understandable using the NLG (Natural Language Generation Module). Again, Google Speech API is used in order to convert the textual sentences into speech which is displayed on the screen and finally spoken aloud by the assistant. The Response time of this system is 3-4 seconds. It is dependent on the speed of internet connection.

8. MODULES

BOT Module The main module, which interacts with every other module and communicates between them by sending the required data and collecting results is the BOT module. The major tasks of the communication process between the user and mirror are handled by it. Some of them are taking the input from user via speech recognition module and send it to the NLG module, so that, the mirror can convert user commands in the form of text which can be handled in the whole process in an efficient way. This command is then sent to the knowledge base and answer to the query is obtained in the form of a JSON object. This object is further processed and presented to the user in the form of speech. In this way, the conversation goes on. Knowledge Base The knowledge base is a type of database maintained by any artificially intelligent machine. It learns from its experience and uses it to answer the questions. The knowledge base of this mirror contains information about the mirror (specific) and the process by which any query can be sent to Wit AI and information can be obtained from it. The response

obtained for any query is then decoded into a set of information and sent to NLG and converted into speech from text. NLG Module NLG module mainly consists of vocabulary, grammar and expressions for the generation of sentences. It is responsible for the generation of natural language sentences formed from information and vice-versa. It is further used by Google Speech Recognition (GSR) for converting text-to-speech and speech-to-text in order to communicate with the users. Speech Recognition Module Speech recognition module is responsible for the conversion of speech obtained by user command, to text and processes it further. It also converts response to any user query from text-to-speech. It uses microphone and speakers as its tools to do so. Backend (Wit AI) The training of this engine goes around Stories (idomain specific use icases). The itool learnsi iconversation flowsi from the iexamples of useri input and ichatbot responsesi. As anyi other NLPi enginei, it iallows comprehending user input after some itrainingsi, iidentifying Intentsi, pulling out iEntitiesi, and forecast whati youri bot shouldi do, based on the present icontext and iuser iquery. Youi can traini your modeli via webi interfacei. The isystem validatesi every isentence againtsi an iexisting modeli and suggestsi highlightingi the pre-built ientitiesi, if any. You can describe your iown entitiesi and set iprobable valuesi for all of themi. Standard iparameters includei locationi, itemperature, idate and time, age, iURLs, emails, ireminders, distancei, etc. Like anyi otheri NLPi engine, itsi functionsi allow it to traini the modeli around a particulari user intent. Apart from that, bot and application developers can benefit from using pre-built models. Among the list of pre-built agents, you will find many general ones, for example, "Navigation", "Hotel Booking", "Small Talk", "Translator", "Weather", "News", etc. However, you can still import "Small Talk" module with common topics like "hello," "goodbye," "emotions," or "courtesy", and make your bot polite. If you wish to train your model manually or personally, you can either put your sentences via web UI or import the model from txt or zip file. Then, you will go through the typical process for NLP engines: define intents, entities and programming actions that bots should do. It is worth to mention that dialog flow supports voice interfaces. It allows you to construct the agent that perceives text and voice without extra efforts. Later, when you test your agent, you can test both text and vocal dialogs. This platform supports about 50 different languages and is completely free of charge. At the moment, the platform supports 15 natural languages. Although, we can desire the number of natural languages, pre-built models, and integrations to evolve over time. The platform is well-documented and has a friendly user interface. Considering the number of pre-built agents, it is really easy to start building a chatbot that fits many platforms at once. Mostly, it is an efficient engine to construct easy or middle level chatbots or virtual assistants with the help of voice interface.

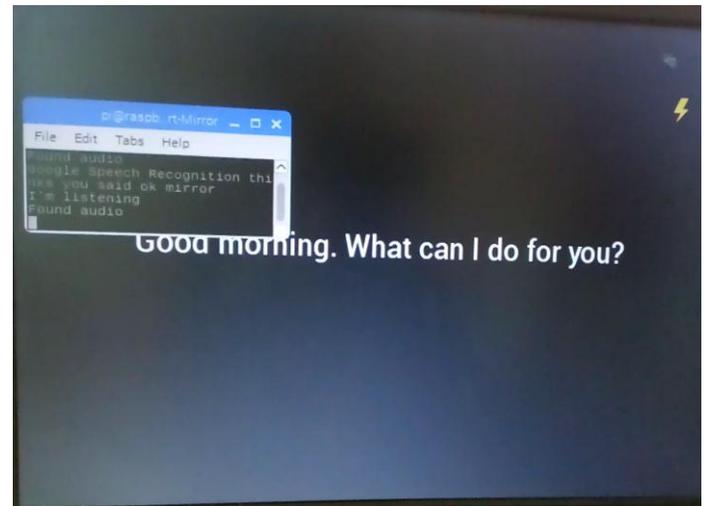


Fig. 2. Initialization

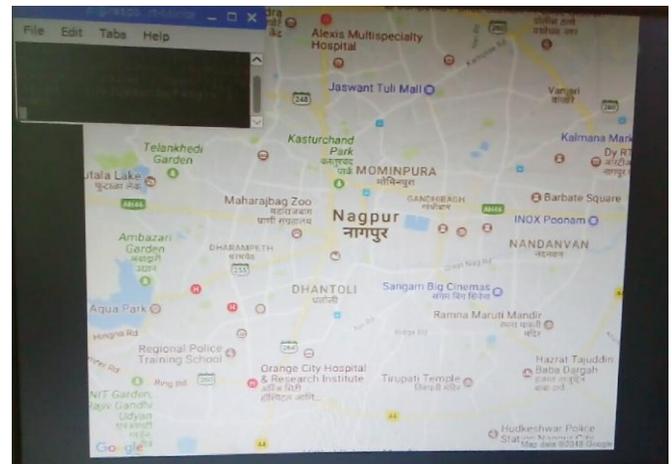


Fig. 3. Roadmap of Nagpur

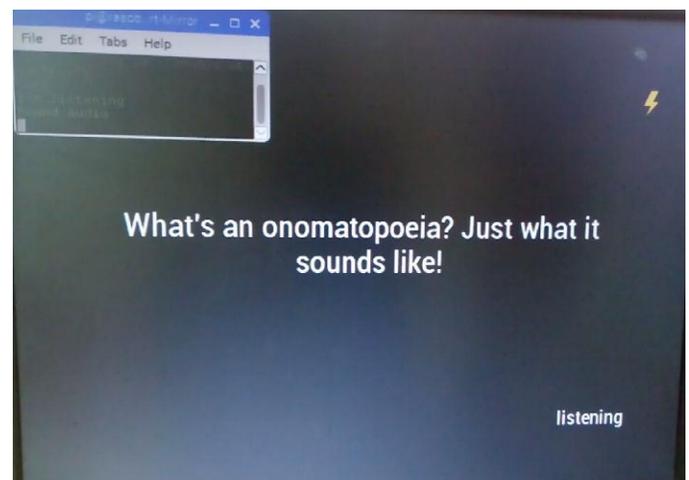


Fig. 4. Joke



Fig. 5. Weather Report

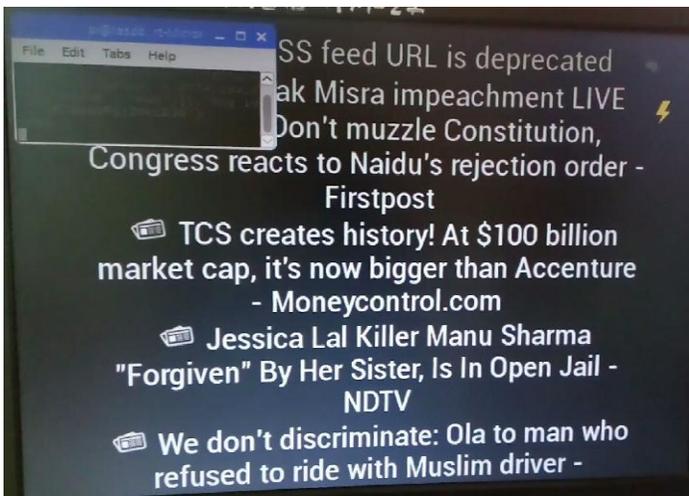


Fig. 6. News Headlines

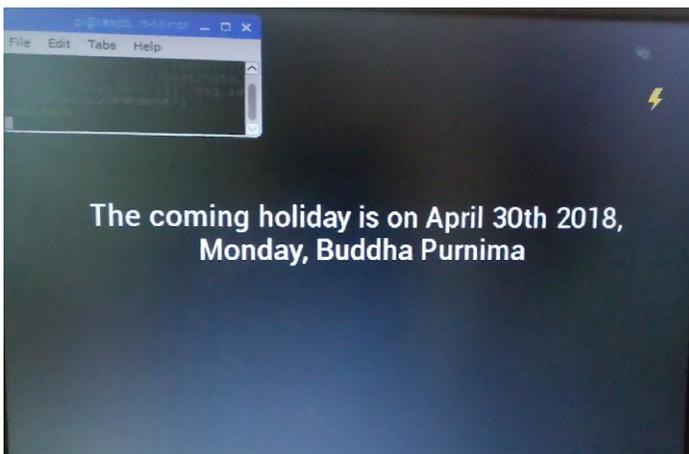


Fig. 7. Details of next Holiday

Also, it would be an economically feasible solution as compared to other assistants present in the market as of now. Expert Systems are an integral part of Artificial Intelligence. We can create an expert system specific to a certain knowledge base by training our bot to do an in-depth analysis of the topic in question. The performance can be improved with usage of high speed internet. The System can be trained for any specific domain and can be used as an expert system.

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CONCLUSION

This project could be used mainly to get daily news, weather reports, and viewing locations through maps etc. by just standing in front of the mirror and interacting with it.