

Smart Speculum

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Abstract

A Smart Speculum is a technology of convenience that optimizes time to its best during one's daily morning chores. It is an application of the Internet of Things (IoT) with which we can interact with the mirror using our voice. This Smart Speculum can provide information like time, news headlines and weather forecast within the time one spends in front of the mirror every day. This information will be sourced from the internet via RaspberryPi which will be the implementation base for this project. The goal is to construct a cost-effective insightful mirror system that not only works as a normal mirror but also is able to display various kinds of information like weather, time and location, current events to users. Home automation is included as well so the user can control home appliances using voice from any corner of the house. This speculum is equipped with object detection with a vision of interactive learning for small kids. This paper states the purpose, construction and operation of Smart Speculum. Keywords— Home Automation, Object Detection, Raspberry Pi, Internet of Things ,TensorFlow, Machine Learning.

I. INTRODUCTION

The mirror will resolve the problems that many people experience every day, getting information without distraction. The interactive mirror is a development effort to augment the mirror with proper fixed information for offering better features that provide personalized data such as date, weather, and regional time corresponding to the location and news headlines. According to survey, we waste 30 minutes on brushing, makeup, and wearing after getting up, and these 30 minutes are also the time for us to observe in the mirror. In order to require full use of this time, in the mirror at same time, we can completely access the relative information of the day. Also, before going to bed, the user may want to know whether it will rain the next morning so that they can plan their exchange.

It is also capable of detecting objects. The proposed system is inter-active in nature, hence it is possible to give commands to the Smart speculum even while grooming up, so as to get required and related information on screen. The primary task of such a system is to display information on the mirror and they accept voice commands. The screens of Smart Mirrors are being designed using an LCD (Liquid Crystal Display) or LED (Light Emitting Diode) monitor along with the two-way Acrylic mirror sheet. The proposed work not only acts as means of providing information but also provides object detection to be applied for interactive learning. Image is being captured by the camera connected to Raspberry Pi and then processed over using TensorFlow API to detect what object is being held in front of it, so that small kids can learn about things without disturbing their parents. This smart speculum comes equipped with home automation. User can control the electrical appliances like lights, fans, air conditioner, coffee machines etc., just using their voice. A separate mic module will be connected to the pi to capture these

voice commands and will be processed using google assistant, giving user a better and convenient control over his/her house. The implementation of this project is explained in further modules.

II.BACKGROUND AND LITERATURE REVIEW

People are often seen rushing through the daily chores. And time for them is so precious that they have to multitask various things like some people eat while they drive, read while eating in order to save time. In this busy life they don't often get time to plan their day in advance and end up forgetting one thing or the other. These people don't usually have time to read news or take the weather update to plan their day throughout this created the need for a device which could do all this for such people before they leave their homes.

Since a person spends a certain amount of time in the bathroom preparing for the day. The mirror would allow a person to review electronic news and information, as well as their schedule, while preparing for the day, e.g. brushing teeth, shaving, styling hair, washing up, applying makeup, drying off, etc. the user would also be able to control home appliances and this can be done without even standing in front of the mirror.

The following attempts toward this approach were made and have been reviewed as follows Smart Mirror Application with Raspberry Pi in [1], features like display weather information, time and location, current event and user information on the mirror with the use of microcontrollers, raspberry pi, NodeJS and JavaScript by signal processing were found. No reference to home automation was found.

The main features mentioned in this paper about the smart mirror is its modular and lightweight nature and extensibility[2]. The project is designed main on the Model-View-Controller (MVC) design pattern in which Model refers to a plugin, View is a screen that displays data and Controller is the server component that controls the execution of each plugin. This model only supports JavaScript and languages which have extensive library support are exempted .

In [3], different hardware's like low power CMOS real-time clock chip, microcontroller and SYN6288 Speech synthesis chip is used, which increases the overall cost of the mirror.This one has ability to provide the listening function offline with the help of sonus technology[4]. Sonus can provide listening function offline for a customizable hot word. Once a hot word is detected, it will be streamed to the user's speech recognition cloud service, then the results shall be received. Offline recognition is not quiet reliable.

The main features mentioned in this paper about the smart mirror is its scalability, adaptability, and security[5]. The project is designed mainly on the Bluetooth module. The user has to connect his Bluetooth enabled mobile device to the smart mirror to access it. But this proposition does not allow the mirror to perform independently.

III.PROPOSED SYSTEM

This system will provide Date, Time, Weather, News update and home automation as basic features. Object detection will be an add on. The following use case diagram shows the complete utilization of the smart speculum.

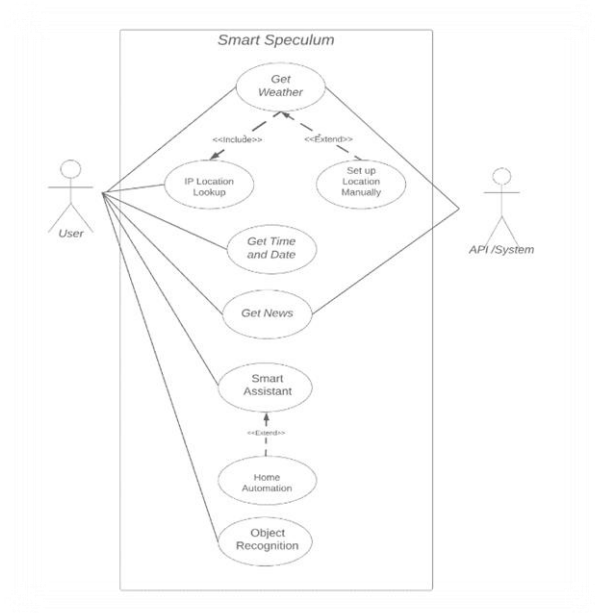


Fig 1: Use Case Diagram

The above use case diagram shows the relation between different use cases and user. These use cases will interact and process as shown in the given flow chart.

The process flow will be as follows

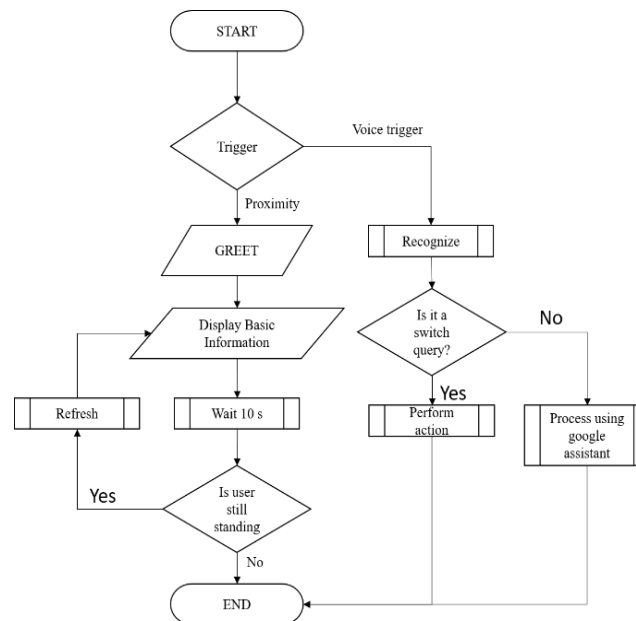


Fig 2: Flow Chart

The above diagram shows the mainstream flow of the smart speculum. Initially the mirror, when powered up, will load the operating system and wait for the trigger. This system has two types of triggers. First one is the proximity trigger which activates when a person stands in front of the mirror within its specified range and the other one is a voice trigger which can be activated by a configurable hotword.

When mirror is triggered with proximity, it first greets the user and simultaneously collects the information like news and weather from the internet and displays it after the greeting along with system's current time and date. The mirror will now check for the presence of user in front of it every 10 seconds and if the user is still standing, it will refresh the news. This will continue as long as the user is in front of the mirror. If the user has now moved away from the mirror, it will stop automatically and go back to the standby mode waiting for trigger again.

To trigger the mirror with voice, first the user needs to set a hotword. This hotword, when called, will activate the mirror and will start listening to the user for command. Then this command will be categorized either as home automation query or as a search query. If it's an automation query, it will be executed and the mirror will go back to standby mode. If it's not an automation query, then it will be serviced using google assistant and after the query is satisfied, mirror will go back to standby mode.

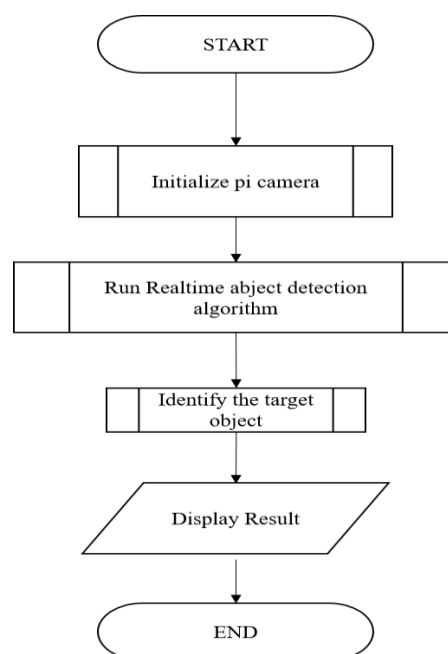
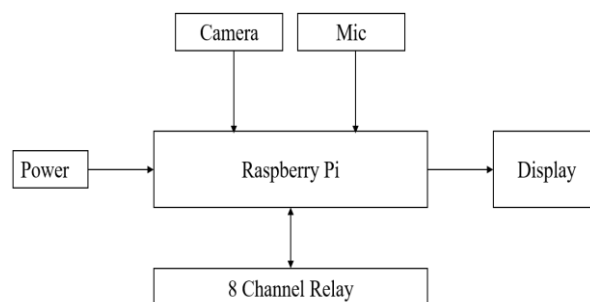


Fig 3: Flow Chart for Object Detection

As this mirror also provide object detection, maintaining efficiency along with auto trigger is a difficult part, so we've included a physical switch to trigger real time object detection algorithm. This algorithm will start running as soon as the button is pressed. It will detect all objects in the frame and will try to target the object that the user desires to be recognized.



The given block diagram shows the basic architecture of the proposed smart speculum.:

Fig 4: Proposed System

The above diagram shows different components of smart speculum. It consists of a RaspberryPi Model 3B to do all the processing, a PiCamera to facilitate object detection, Display monitor to show all the necessary information, 8 channel relay to interface with the switch board for home automation, a microphone to listen to user queries and finally a power supply. All these components when connected together can serve as implementation setup for the smart speculum.

The software implementation of smart speculum will be done using python. RaspberryPi runs on Debian based Raspbian OS. All the python scripts will be included within the OS files for hassle free setup for the user. On powering up the mirror, the basic scripts will start loading automatically and will be ready in standby mode waiting for triggers as mentioned above.

IV.CONCLUSION

Smart speculum has ability to augment people's day to day lives by providing necessary information on the go. This system once implemented, doesn't need complex set-up, a simple power up from mains switch can get the system up and running. This project will reduce the need to keep checking the phone or other sources for different information. The ability to interact with voice also eliminates the need to come in front of the mirror to be able to access it. This concept can further be modified according to user specific needs, which may include smart mirror in malls which lets you try different clothes without actually trying them. This cuts of the need for trial rooms and can save space and time. It can also be used in jewelry shops, so that shopkeepers don't have to risk expensive jewelry with unknown customers. These are some of the future possibilities for this project, many more to come.

V. RESULT



The following image shows the output of the smart speculum. It has shows the current system time, the weather information and the news headlines of the day.

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