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"Brilliantreflect": smart mirror for smart life

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Article Info

ABSTRACT

In this globalization era, smart mirror have been one of the invention to represent futuristic interconnected physical object with several applications. Smart mirror is innovating appliance that incorporates with contextual information which offered the interactive user interface on the surface of a mirror with the use of Raspberry Pi 3. To create this smart mirror the methodology that includes analysis about smart mirror, designing the hardware and software, developing the prototype, implementation and lastly the evaluation phases needs to be take care of. The presentation performed on the mirror will be information such as weather, time and date, holiday calendar, to-do list by mobile synchronization, current traffic of selected area, news feed and compliment as a motivation. Furthermore, our framework also introduces music presentation that use for alarm purpose. In a nutshell, this mirror what we called "Brilliant Reflect" will be convenient to use as it provides various features to the user.

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1. INTRODUCTION

Smart Mirror is the technology that is introduced as a two-way mirror with an electronic display behind the glass as the world around us is constantly changing with the advancement of technologies [1]. Smart Mirror is growing in popularity due to its interactive way in communicating user with technology. Living with the advancement of science and technology requires us to keep moving towards faster and easier life. All of smart appliance being used daily are basically based on intelligent Internet of Things (IoT) devices. The IoT, refers to billions of physical devices around the world that are now connected to the internet, collecting and sharing data [2]. The term IoT is mainly used for devices that wouldn't usually generally expected to have an internet connection that can communicate with the network independently of human action1.

The evolution of IoT in human society since 1982 which is Baron Schilling in Russia, create an electromagnetic telegraph, and in 1833, Carl Friedrich and Willhelm Weber invented their own code to communicate over a distance of 1200 meter within Germany [2] makes this invention become truly practical in our today's life. Recent advance in technology in implementing IoT in life is smart cars which is made to provide the auxiliary driving or automated is from a safe and comfortable level to solve human driving requirements [3]. The development of the application has been made to replace the original method which is involved more energy and works.

Home automation system is also famous for using intelligent IoT device. Home automation is the use of one or more computers to control basic home functions and features automatically and sometimes remotely. An automated home is sometimes called a smart home [4]. By using IoT for home automation has

many real life applications such as building a switch to control the lights based on the presence of the person in the house. This project is undertaken to be used in daily life while preparing their day out of the house every day through intelligent assistant.

The consumer experience and journey in front of the mirror is measured at all times as the mirror provided various information that we need are right in front of us [5]. It makes life easier as the need to look at phone every time to check on information such as weather and date, is reduced. The measurement is consistent across the whole retail network, and provide an invaluable set of daily routines to enhance management decision process. Realizing the potential benefits of the smart mirror, companies like Microsoft and Apples have come up with their own prototypes of the mirror [5].

The objectives of this paper is to present the implementation of a smart mirror using IoT. A smart mirror is capable in displaying the date, time, weather, traffic condition on it reflecting surface, reminders that will remind the user regarding the schedule that they have which are updated from the calendar and voice recognition. These features will be scrapped from the internet and implemented using raspberry pi board. The pi board is programmed using Linux OS. By using stack method to create the display page and Javascript is used both at client and server side [5, 6].

The paper is organized as follows where Section 2 discuss on related study on this domain. Section 3 discuss the features of prototype and its elements. Section 4 elaborates the preliminary evaluation conducted and discussion on the result obtained. Finally, the paper concluded with future work. Literature review that has been done author used in the chapter "Introduction" to explain the difference of the manuscript with other papers, that it is innovative, it are used in the chapter "Research Method" to describe the step of research and used in the chapter "Results and Discussion" to support the analysis of the results [2]. If the manuscript was written really have high originality, which proposed a new method or algorithm, the additional chapter after the "Introduction" chapter and before the "Research Method" chapter can be added to explain briefly the theory and/or the proposed method/algorithm [4].

2.   RELATED WORKS

This section will covers about the related projects that has been done that is also related to our project known as the "BrilliantReflect" that is able to function with the use of Raspberry Pi. The smart mirror has been helpful people from various aspects which depends on the developer what are the objectives to be achieved as different kind of features can be included into the smart mirror. Nowadays, smart mirror will not only reveal whether you are the prettiest of them all. It will also inform about the time, date, weather, upcoming calendar appointment [7]. There are some Smart Mirror projects that have been developed by the developer around the world.

There are also a smart mirror that facilitates access to personalized services and control of household smart appliances in the ambient home environment. This is an attempt to contribute to the design of smart mirror-like interface as well as the smart environment in which the interface is used for interaction [8]. One of the example of smart mirror for ambient home environment is The AwareMirror. The AwareMirror [8]. In [9] explained that it is an augmented display that is placed in the bathroom for presenting personalized information to the user. It detects the position of a person in the bathroom using a proximity sensor and identifies the person from the usage of toothbrush. It provides useful information such as closest schedule, transportation information and the weather forecast. Although it attempts to provide an intuitive interface, it has some limitations that may restrict it from wider usage. For example, the state-of-use of a toothbrush for identifying a person might not provide accurate states to personalize information. Also, the use of magic mirror restricts dark colours from going through it and hence requires special attention to the colour of the contents to be displayed.

The Memory Mirror [8, 10] from the Everyday Computing Lab acts as an assistant to the elderly people by graphically showing the status of drug usage over a 24 hours period of time. It keeps track of all the drugs removed from the medicine cabinet and records it in a history log in order to display the details of previous usage and to warn about possible lost or misplaced items.

The Memory Mirror heavily depends on the RFID technology and requires attaching RFID tags to the household items and RFID reader to know the status of these items. Radio-frequency identification (RFID) [11] uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically-stored information. It may not be used as a traditional mirror and it is not suitable as an interface to access personalized services and to control household appliances which are the two main goals we intend to achieve.

Mirracle [12] which is an augmented reality magic mirror is used for teaching anatomy. The system uses a depth camera to track the pose of a user standing in front of a large display. A volume visualization of a CT dataset is augmented onto the user, creating the illusion that the user can look into his body. Using

gestures, different slices from the CT and a photographic dataset can be selected for visualization. In addition, the system can show 3D models of organs, text information and images about anatomy. For interaction with this data they present a new interaction metaphor that makes use of the depth camera. The visibility of hands and body is modified based on the distance to a virtual interaction plane. This helps the user to understand the spatial relations between his body and the virtual interaction plane.

There is also an augmented rendering of makeup features in a smart interactive mirror system for Decision support in cosmetics products selection [12]. The author propose a smart mirror system to display an augmented 3D representation of the user with makeup features. In this approach the user is able to view the possible outcomes of different makeup applications in the smart mirror without affecting the real face appearance in the process. The system incorporates 3D face construction, IR based face tracking and OpenGL material extensive rendering approach to deliver the augmented made-up face. They argue that by viewing the augmented grooming features the users will be able to flexibly decide the makeup products of their choice.

The projects stated above such as the Memory Mirror, Mirracle and augmented rendering of makeup features are indeed very useful to people but it will only be useful to specific range of people. Therefore, in comparison to the projects described above, our projects can be used by a wide range of people as they can display the smart mirror in their home environment. Our project also has some similarities with the AwareMirror where it provides useful information such as displaying the forecast. Basically, everyone has the possibility to use this smart mirror as our proposed smart mirror represents a natural and resourceful interface that guides the user by giving them information on what's happening in their daily life.

3.   METHODOLOGY

"BrilliantReflect" been developed through the phases in ADDIE model. The phases in ADDIE model includes analysis, design, development, implementation and evaluation. ADDIE model is useful in order to make the process of developing of "BrilliantReflect systematically and allow evaluation of the prototype conducted effectively to ensure any errors are avoidable during the implementation phases. Figure 1 shows the data flow diagram of ADDIE model.
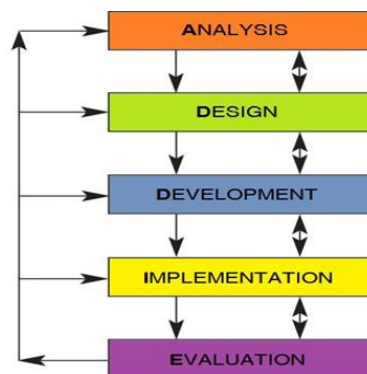

Figure 1. ADDIE model flow diagram

3.1. Analysis

Throughout this phase, we analyzed on many aspects about the smart mirror. The aspect that we focused on is the problem related statement about the current situation that urged us to develop this smart mirror. After analyzing the problem, we decided on the objective to be achieved and the significant of this project for the user. Analysis was also conducted to determine the scope of user suitable for the usage of the smart mirror. Besides that, software and hardware for the smart mirror were also analyzed in ensuring approximately applied in the design and development.

3.2. Design

In this phase, features and locations to be added into the "BriliantReflect" was determined for the smart mirror interface. Designing on the wood working was also conducted as to set the frame appropriately with the monitor, two-way mirror and raspberry pi was arranged for user convenience to be used and shown as a real mirror.

3.3. Development

In the development phase, the first step was getting all the equipment needed to develop this project. Once the equipment has been prepared, Raspberry pi were used which is the main focus in developing the features for the smart mirror. Raspbian operating system was used for to install particular modules. After getting the modules, used HTML, CSS and Javascript was used in editing the features and to make it compatible for the current location. After completing the features, frame wood working was conducted for the smart mirror.

3.4. Implementation

After development, the "BriliantReflect" was tested with the potential user to identify the effectiveness of the smart mirror for daily usage. During this phase, user were identified from group of 18 to 28 years old as they are the active Internet user generation and known to be hooked with technology advancement in their daily life. As such, "BriliantReflect" would be an important technology to be added in their daily life.

3.5. Evaluation

Evaluations are the final phase in determining the errors in the "BriliantReflect" features and identify user efficiency in using the smart appliance features. Once evaluation was conducted, the data was collected to be analyzed using statistical analysis package. Through this, effectiveness of the application will be measured and enable to identify future enhancement to be done in the "BriliantReflect".

4. DEVELOPMENT

The developed project prototype operates on a two-way mirror with an electronic display behind the glass which is a monitor with Raspbian based operating system. Relevant material which is Internet connection are needed to be used with this project since it is an Internet of Things (IoT) based project. Development of the project prototype was done by implementing the interface and the functionality of each information shown in the mirror with the integration of the technology. There are few software that are used together with the features in the smart mirror in order to operate the project such as Todoist Application, Google Map and Calendar.

Then smart mirror only intended be used as information panel. The features of this mirror are divided into three sections. The purpose of dividing the features into these section is to differentiate the information that will be received by the user. On the right side of the mirror, information such as Clock, alarm, weather and traffic are shown to provide user with daily information. Malaysia holiday's calendar and daily reminder of the user are displayed to ease the user in making decision. Refer Figure 2, on the other hand, the bottom section of the mirror provides daily quotes and news to motivate the user.

Figure 2. Interface of "BriliantReflect"

4.1. Clock, date, weather and traffics

The clock and date information are displayed at the right top of the mirror. The clock that we used is using 24-hour format and the date are based on Kuala Lumpur time zone. The temperature and the humidity of the places of this mirror is set at Panchor region. It will display the weather of Panchor region for the entire week. The traffics shown in the mirror are based on google map which is in Panchor region. The color of the road will be display in green as the traffic was smooth while changed to red if the traffic was bad, refer Figure 3.

Figure 3. Date and time

4.2. Alarm clock

The alarm of this mirror is already set by the user such as the exact time to wake up and the user's daily routine such as soccer, class and more. Refer Figure 4. The alarm will ring for the total of one minute. The audio of the alarm is the basic sound which will be played on the speaker of the mirror.

Figure 4. Alarm notification

4.3. Daily reminder and holiday calendar

The smartphones are not a mandatory accessory for smart mirror but it is a very convenient way to interact with it because it acts like a remote control. That's why we provide this method for daily reminder features of this mirror. User can modify their schedule by using their phones. This is because the Todoist Application that we are using are connected with the mirror. The user also gets notifications in mirror and their phones. Holiday Calendar of this mirror are listed based on ICS Malaysia's Calendar template. The format of the calendar and the way it was sorted are determined by the template, refer Figure 5.

Figure 5. Holiday reminders

5.   CONCLUSION

Based on the study conducted on the related smart mirror projects, smart mirror is proven to be useful in this globalized world where smart mirror is part of the technology that makes professional works more convenient and efficient nowadays. However, this prototype of smart mirror will enable the people around the world to have the chance to experience this smart mirror as this resourceful interface can be displayed in the home area where most likely all the people have. As future works, this smart mirror will be enhanced by with speech recognition artificial intelligence for more efficient usage. Besides that, evaluation will also be conducted to ensure the effectiveness of the "BrilianReflect" for the potential user.

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