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Smart Mirror for Smart Life

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***Abstract*—** Internet of Things (IoT) is a concept where an object having the ability to transfer data over a network without the need for human interaction to human or human to computer. IoT is known for its advantage that can help simplify people's everyday routine. Hence, the researcher comes with a proposed system called Smart Mirror. It is a concept of smart home-based Internet of Things (IoT). This system allows users to access information and also control the lights in the house. Relevant information can be traced such as time and date, weather, warning, traffic, and location map. The system applies Sonus technology as a medium of interaction between people and systems. So, users need to provide instructions to the system orally to acquire the system's response. The methodological approach used in this project is The Evolutionary Prototyping which gathers all requirements and designs the system in a quick method. A prototype is built to evaluate and deliver feedback. Improvements will be made to enhance the prototype, catering to user's satisfaction. Sonus is a speech to text library that can quickly and easily add a VUI (Voice User Interface) to any hardware or software project. Similar to Alexa, Google Now, and Series, Sonus can always provide listening function offline for a customizable hotword. Once a hotword is detected, it will be streamed to user's speech recognition cloud service, then the results shall be received. With Smart Mirror system, users can manage their daily activities at ease as well as solving many problems in managing some house chores.

Keywords—smart mirror; smart home; Internet of Things

I. INTRODUCTION

Internet of Things (IoT) is a term used to describe "technologies, systems, and design principles associated with the emerging wave of Internet-connected things that are based on the physical environment" [1]. It refers to a network of uniquely identifiable things (objects) and their virtual representations in an Internet-like structure, which are able to collect and exchange data and are remotely controlled across existing network infrastructure [2, 3, 4]. It comprises of major components including sensing function, heterogeneous access, information processing, security, privacy, and applications and services.

According to the International Telecommunication Union (2013), the term Internet of Things (IoT) is defined as a global structure for society that enables Internet service to connect to physical matter based on information and communication technologies available. IoT is also seen in a broader perspective and nonetheless brings quite a huge implication of technology on society [5].

Along with the development of technology, various information can be found easily and the emergence of the concept of Smart Mirror Smart Home has become increasingly widespread. The Smart Mirror system which is based on the concept of Internet of Things (IoT) is developed specifically to allow users to manage and control house appliances through voice recognition.

In this case, managing house appliances has been identified as the main problem faced by most people. There are just too many things to be done at one time and at certain point, users are not able to multitask such daunting chores. For example, when a to-do-list with a number of house chores has been recorded on a paper, but the paper is lost because it is misplaced. Another example is when users are too busy managing their daily activities until some trivial-yet-critical things are forgotten such as switching off the lights in a room, which can eventually lead to energy wastage.

To deal with this situation, Smart Mirror is developed to provide convenience for users in managing things and control the usage of electrical appliances in the house with network connection between the lamp and the device. Users are required to give instructions to the system orally, and the system's sensors will recognize the voice of

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the consumer to receive instructions and respond to users' needs.

The proposed system is developed based on three objectives:

1. To design a prototype Smart Mirror using Raspberry PI
2. To develop a voice recognition system to facilitate the implementation of Smart Mirror.
3. To carry out the testing process on Raspberry PI for usability evaluation to users.

II. SYSTEM IMPLEMENTATION

This chapter explains the methodology selected in completing this project. A methodology in this context refers to the splitting of development work to distinct phases containing activities with the goal of a better planning and management [6]. The Methodology approach used in this project is called The Evolutionary Prototyping. Prototype model is a life-cycle model that allows applications to be developed in stages so that it can be modified easily according to feedback from users [7]. Evolutionary prototyping focuses on gathering a correct and consistent set of requirements. The process lends particular strength to building quality software by means of the ongoing clarification of existing requirements and the discovery of previously missing or unknown requirements. Traditionally, the iterative reexamination of a system's requirements has not been the panacea that practitioners sought, due to the predisposition for requirements to creep over and the difficulty in managing such requirements [8]. Figure 1 shows a flow chart of the system implementation in Smart Mirror. Users can give instructions to the system to view a list of commands that are available. Then, they can give commands via voice instructions provided. Figure 2 to Figure 8 present the main interfaces available in Smart Mirror.

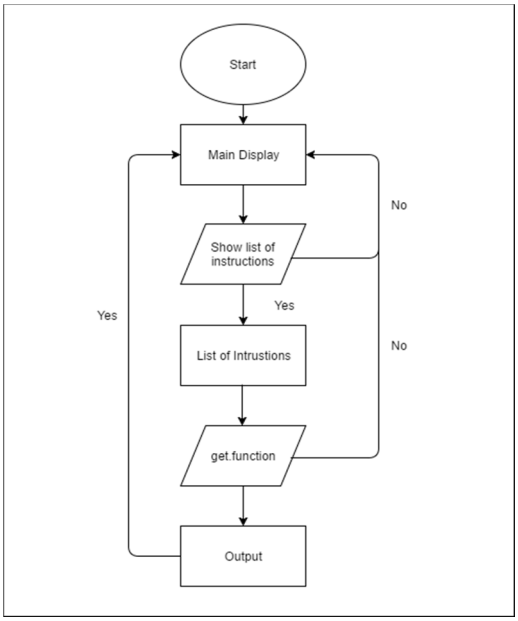

Figure 1. Flowchart of Smart Mirror.

E. User Interface system

Figure 2. Main Display of Smart Mirror.

Figure 3. List of instructions to be selected by user.

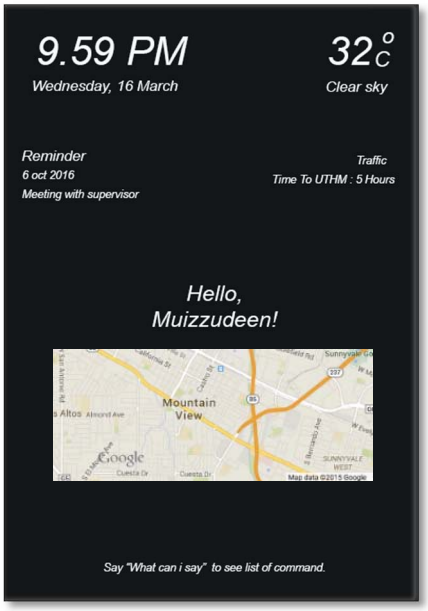

Figure 4. Example of the system's response when the user gives instruction to get location map.

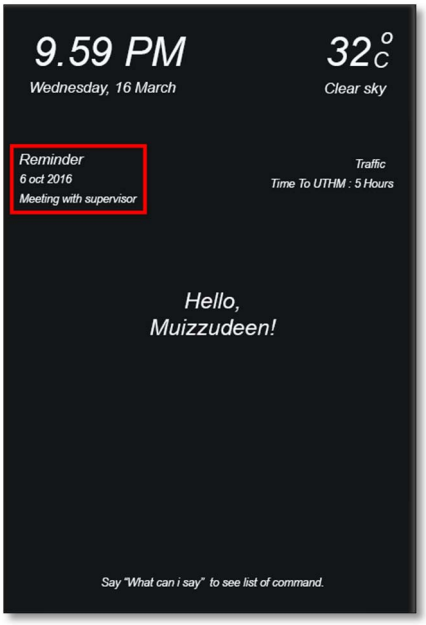

Figure 5. Example of the system's response when the user gives instruction to create reminder.

F. Web-based User Interface

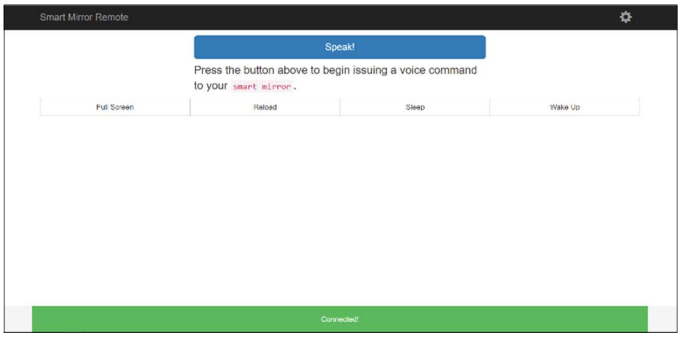

Figure 6. Main display of the web-based interface. The 'Speak!' button is provided for users to issue a voice command.

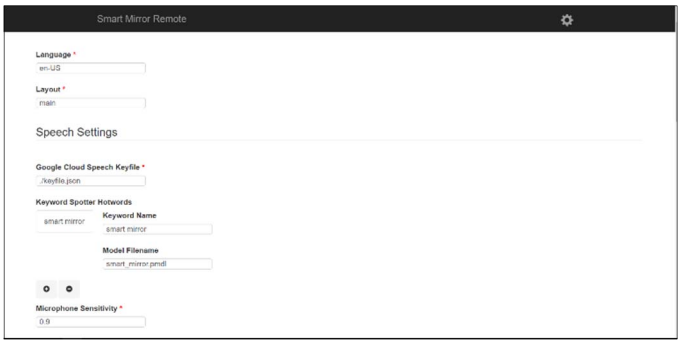

Figure 7. Example of the system's response when the user gives instruction to create reminder.

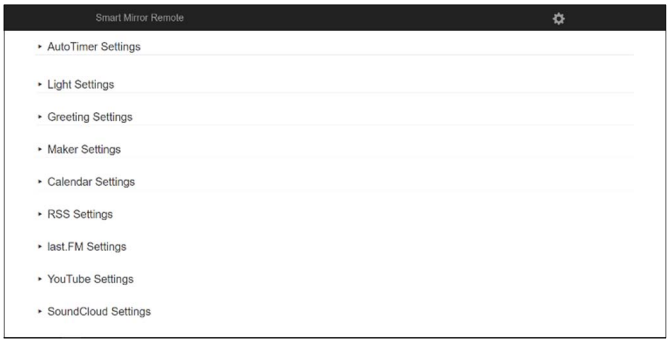

Figure 8. Various function settings are provided.

III. SYSTEM TESTING

A group of developers have conducted several tests on the system to ensure that the system meets the functional requirements. There are three sections involved in the testing phase, which are test cases, expected results and actual results. The term "Success" and "Fail" indicates whether the field has performed well or resorted into failure. To implement and test the developed system, Google Chrome has been selected as the web browser. Developers have tested the system using unit testing method, starting from the design of webpage to the system's functions. Unit testing was the selected technique as it can help in isolating bugs. Table I shows the results of unit testing carried out by the developers.

TABLE I. UNIT TESTING RESULTS

Test Case	*Expected Result*	*Actual Result*
Design of webpage is clean and easy to view	Display content in correct order, user can clearly understand.	Success
Text box and text area are able to capture the data entered	Data can be entered successfully.	Success
Different types of data are entered including negative number, positive number, and special characters	System's validation function is able to validate the input data according to the criteria set in the input element of user interface. System is able to alert user on wrongly entered data type.	Success

Table II shows the results of system testing. This testing method was selected for testers to evaluate the system's functional criteria.

TABLE II. SYSTEM TESTING RESULTS

Test Case	*Expected Result*	*Actual Result (1)*	*Actual Result (2)*
Running the system	• Running Smart Mirror	Success	Success
Configure PI	• Rotate monitor • Disable screensaver and remove panel • Hide the mouse during inactive mode	Success	Success
Configure sound	• Audio input and output configuration	Success	Success
Configure voice	• Setting up Speech Recognition	Fail	Success
Control lights and allow Enabling Motion Detection	• ConfigUI to configure and enable motion detection	Fail	Success

The tests involved were divided into unit testing and system testing. After the unit testing was carried out on Smart Mirror, with one-time evaluation, there were no problems encountered in terms of webpage design where it is found clean and easy to view, text boxes and text areas are able to capture the data entered and different types of data can be entered including negative number, positive number, and special characters.

Meanwhile, in system testing, the evaluation criteria include running the system, configure the PI, configure the sound, configure the voice and control the lights and allow enabling motion detection. This test was performed twice and the results are shown in Table II. The first test was performed with two test cases resorted into failure, i.e. configuring the voice and controlling the lights and allow enabling motion detection. After some maintenance, the test was performed for the second time. The second test presented improved results where all functions of the system worked properly.

IV. Conclusion

As a conclusion, the application is the new technology for smart life. From the result testing, most of the function of the application are functioning well and there still need some improvement to the development of the newest functionality on smart mirror. This system could be enhanced by referring to various other systems and applications available such as [9-14].

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References

[1] Holler J., Tsiatsis V., Mulligan C., Avesand S., Karnouskos S., Boyle D.M2M to IoT—the vision: from M2M to IoTFrom Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence20141stchapter 2, section 2.2Oxford, UKAcademic Press1418 Google Scholar

[2] Chen M., Wan J., Li F.Machine-to-machine communications: architectures, standards and applicationsKSII Transactions on Internet and Information Systems20126248049710.3837/tiis.2012.02.0022-s2.0-84861022395 Google Scholar CrossRef

[3] Internet of Things Global Standards Initiative2015Geneva, SwitzerlandITU: Committed to connecting the world

[4] Williams J.Internet of Things: Science Fiction or Business Fact?Harvard Business Review Analytic Services Report, December 2014

[5] International Telecommunication Union (2013). Harnessing the Internet of Things for Global Development. https://www.itu.int/en/action/broadband/Documents/Harnessing-IoT-Global-Development.pdf

[6] Centers for Medicare & Medicaid Services (CMS) Office of Information Service (2008). Selecting A Development Approach. Retrieved on October 27, 2016 from www.cms.gov/Research-Statistics-Data-and-Systems/CMS-Information-Technology/XLC/Downloads/SelectingDevelopmentApproach.pdf

[7] Ian Sommerville (2007). Software Engineering. 8th ed. United States: Pearson Education, Inc.

[8] R. A. Carter, A. I. Anton, A. Dagnino and L. Williams, "Evolving beyond requirements creep: a risk-based evolutionary prototyping model," *Proceedings Fifth IEEE International Symposium on Requirements Engineering*, Toronto, Ont., 2001, pp. 94-101.

[9] Kasim, S., Hafit, H., Yee, N. P., Hashim, R., Ruslai, H., Jahidin, K., & Arshad, M. S. (2016, November). CMIS: Crime Map Information System for Safety Environment. In IOP Conference Series: Materials Science and Engineering (Vol. 160, No. 1, p. 012096). IOP Publishing.

[10] Kasim, S., Hafit, H., Leong, T. H., Hashim, R., Ruslai, H., Jahidin, K., & Arshad, M. S. (2016, November). SRC: Smart Reminder Clock. In IOP Conference Series: Materials Science and Engineering (Vol. 160, No. 1, p. 012101). IOP Publishing.

[11] Kasim, S., Hafit, H., Juin, K. P., Afif, Z. A., Hashim, R., Ruslai, H., ... & Arshad, M. S. (2016, November). BBIS: Beacon Bus Information System. In IOP Conference Series: Materials Science and Engineering (Vol. 160, No. 1, p. 012097). IOP Publishing.

[12] Kasim, S., Xia, L. Y., Wahid, N., Fudzee, M. F. M., Mahdin, H., Ramli, A. A., ... & Salamat, M. A. (2016, August). Indoor Navigation Using A* Algorithm. In International Conference on Soft Computing and Data Mining (pp. 598-607). Springer, Cham.

[13] Kasim, S., Azahar, U. A., Samsudin, N. A., Fudzee, M. F. M., Mahdin, H., Ramli, A. A., & Suparjoh, S. (2016, August). E-Code Checker Application. In International Conference on Soft Computing and Data Mining (pp. 570-578). Springer, Cham.

[14] Mahdin, H., Senan, N., Kasim, S., Ibrahim, N., & Abdullah, N. A. (2014). Teaching computer programming to IPAD generation.