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Web-Based Automobile Service Reminder System

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Abstract. Vehicle owners' failure to service their vehicles on schedule results in major auto repair issues. Sticker reminders, which are now used to track car service activities, make it difficult for the owner to keep track of routine maintenance. As a result, a Web-based Automobile Service E-Assistant system for recording and controlling auto service activities is proposed in this study. This system would help both the mechanic and the car owner keep track of and manage upcoming service jobs and appointments. The system requirements were identified by comparing existing applications. The system is then designed and developed based on the specifications gathered. To assess the usability of the system, a usability evaluation study was conducted. The usability evaluation revealed that the respondents deemed the website to be a helpful tool in organising their service activities. This demonstrates that the system has the ability to serve as a support and assistive tool for car owners.

INTRODUCTION

Too many responsibilities, stress, anxiety, or depression can lead to forgetfulness, disorientation, difficulty concentrating, and other issues that can impair daily tasks. People suffering from forgetfulness can benefit from advances in information and communication technologies. An application can be created to save data and then prompt for it when it is needed. That system is called reminder system. A reminder system is a form of time management computer application that notifies the user of key events that they have entered into the system.

Vehicle service and maintenance is one of the common problems face by most vehicle owners. Scheduled service and maintenance such as maintaining the cooling system, transmission system, drivetrain, and other components can help to avoid wear off and costly repairs. However, due to their hectic schedules, many vehicle owners neglect to service their vehicles on time.

Several standard service facilities maintain track of their clients' records and give them reminders when maintenance services are necessary. However, many small or local service facilities does not provide such services. Hence, stickers are simply used as a reminder of the service task. This method is ineffective since no record of the specific service task is kept. Furthermore, when exposed to sunshine, the sticker may flake off or fade, resulting in the loss of information about the next service assignment.

To address this issue, procedures that allow vehicle owners to efficiently record and track auto care activities at local mechanic shops are urgently needed. Therefore in this paper an online platform for managing car servicing activities is proposed. The proposed system is called the Automobile Service E-Assistant.

RELATED APPLICATIONS

According to the studies, managing car service activities has traditionally been accomplished through a variety of approaches, including paper-based systems, mobile and web-based applications for service scheduling and maintenance histories. A reminder sticker and an auto service record book are paper-based solutions for tracking periodic maintenance data. Study by Rohl et al., (2016) have shown that windshield sticker reminder can be a good approach to alert the car owner.

However, the rise of smartphones has made this chore easier with mobile apps. The apps can facilitate the communication between the car owner and the service center (Chavan et al., 2014). In addition, the apps can assist the car owner to locate the service centre, obtain its address, and review the services offered. Example of the apps are MyMazda (mymazda.com) and Ufirst (ufirst.com.my). MyMazda was created specifically for Mazda vehicles, while Ufirst was created specifically for Perodua vehicles. MyMazda allows users to access vehicle information, locate and map service centres, and schedule reminders. Ufirst offers an E-appointment solution for scheduling car servicing maintenance. Ufirst also has a sales and service locator, as well as auto breakdown and e-payment capabilities.

Despite the fact that the AppStore has a plethora of mobile apps, there has been minimal study into organising car service activities at local mechanic shops. According to previous studies such as Shahlol et al., (2018) and Jain & Subhedar (2016), web-based apps consume low-end user computing resources, and the use of a web browser should be the minimal requirement.

Web-based applications are accessible regardless of operating system and are compatible with practically every platform. It is generally low-cost to produce and does not require download space (Shahlol et al., 2018). Since mechanics shops have limited financial resources, the system's affordability is a significant barrier for them (Jain & Subhedar, 2016). Furthermore, for the convenience of vehicle owners, the system can reduce complexities in the administration procedure (Sale et al., 2018).

METHODOLOGY

The project's system development approach was based on the waterfall model shown in Figure 1. The waterfall model provides an ordered sequence of implementation steps and aids in ensuring the adequacy of documents and design revisions to assure the consistency, usability, and maintainability of the developed website. System requirement analysis, design, implementation, testing, deployment, and maintenance were the six phases of this paradigm.

Existing applications such as MyMazda and UFirst are examined during the system requirement analysis phase to gather requirements and features for the website. Use case diagrams, sequence diagrams, and class diagrams were developed to visualize the website's needs and flow during the design phase. The website was developed using PHP language and MySQL database. The PHP-based email infrastructure is also used to allow the system to deliver the notification to the user (Osman et al., 2017). The website's user interface was created using Cascading Style Sheets (CSS), Hypertext Markup Language (HTML), and scripting languages such as JavaScript.

Usability testing is carried out throughout the testing phase to assess the website's usability. The system is then updated based on the comments provided by the respondents.

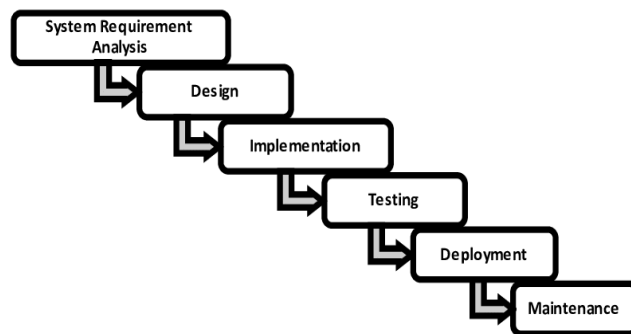


FIGURE 1. The Waterfall Model

DESIGN AND DEVELOPMENT OF AUTOMOBILE SERVICE E-ASSISTANT

This section discuss the design and development of the Automobile Service E-Assistant system.

System's Requirements

The Automobile Service E-Assistant website's requirements were gathered by comparing available applications on the market. Perodua's Ufirst and Mazda's MyMazda were the two mobile applications chosen at this level. Nine characteristics have been discovered based on these applications. Login/registration, notifications, locator, maintenance schedules, history, roadside help, car finder, compatibility, and emergency contact are among the nine functions. To elicit needs for a website that can manage car service activities, problems with present applications were also identified. Table 1 outlines the requirements for the system derived from the system requirement analysis and the requirements for the system's admin is shown in Table 2.

TABLE 1. List of Requirements for the User of Automobile Service E-Assistant

ID	Requirement Description	Priority
1	REGISTRATION	
1.1	A new user shall be able to register to the web-based system by key in username,full name,email,phone number, address, state , password and confirmation password.	MANDATORY
1.2	if fields are empty, an error message for that particular field will appear on form.	DESIRABLE
2	LOGIN	
2.1	The existing user shall be able to login to the system by selecting user type and entering username and password.	MANDATORY
2.2	if the user enters the wrong password or username, an error message, “wrong username/password combination” will be displayed on the login form.	DESIRABLE
2.2	The web-based system shall be able to allow the user to click “Forget password?” for the system to recover user’s password.	OPTIONAL
3	MANAGE USER PROFILE	
3.1	The user shall be able to update profile information	MANDATORY
3.2	The system shall be able to allow the user to click the menu “MyProfile” rendered from “profile icon” dropdown menu	DESIRABLE
4	MANAGE VEHICLE INFORMATION	
4.1	The user shall be able to add vehicle information on the form provided.	MANDATORY
4.2	The system shall be able to allow user to click menu “Add Car” rendered from “SERVICES” dropdown menu	DESIRABLE
4.3	The user shall be able to fill in vehicle information such as car brand, car model, car plate number and car fuel type on the car form given on the system.	DESIRABLE
4.4	The user shall be able to click “Submit” on the car form	DESIRABLE
4.5	The system shall be able to store the car information on the database of the user.	DESIRABLE
4.6	The system shall be able to display stored car information to the user.	DESIRABLE
5	MANAGE REMINDER FOR AUTO SERVICE ACTIVITIES	
5.1	The user shall be able to set reminder for auto service activities.	MANDATORY
5.2	The system shall be able to allow user to click menu “E-Reminder” rendered from “SERVICES” dropdown menu	DESIRABLE
5.3	The system shall be able to allow the user to click “+” on the car information table to set a reminder.	DESIRABLE
5.4	The user shall be able to select the workshop name from the list of workshop names on the reminder form.	DESIRABLE

ID	Requirement Description	Priority
5.5	The user shall be able to select date from the date picker to set reminder (Next service date, Battery change date, Tyre change date, Oil filter due, Coolant expiration date)	DESIRABLE
5.6	System shall be able to allow user to key in other details(Oil type/grade, Mileage of next service, other services)	DESIRABLE
5.5	The user shall be able to click “Submit” on the reminder form	DESIRABLE
5.6	The system shall be able to store the date set for the reminder of auto service activities.	DESIRABLE
5.7	The system shall be able to display stored reminder information to the user.	DESIRABLE
5.8	The system shall be able to send auto reminders via email to users on dates that have been set. .	DESIRABLE
6	SEARCH MECHANIC SHOP LOCATION	
6.1	The user shall be able to search the location of nearby mechanic shops.	DESIRABLE
6.2	The system shall be able to allow the user to select state and city from dropdown menu	DESIRABLE
6.3	The system shall be able to display local mechanic shops(Workshop Name, Address, Phone number)	DESIRABLE
7	View Past History	
7.1	The user shall be able to view past history of vehicle service.	MANDATORY
7.2	The system shall be able to display the history in form of table to the user.	DESIRABLE

TABLE 2. List of Requirements for the Admin of Automobile Service E-Assistant

ID	Requirement Description	Priority
1	LOGIN	
1.1	The admin shall be able to login to the system by selecting user type and entering username and password.	MANDATORY
2.2	if the admin enters the wrong password or username, an error message, “wrong username/password combination” will be displayed on the login form.	DESIRABLE
2.2	The web-based system shall be able to allow the admin to click “Forget password?” for the system to recover the user's password.	OPTIONAL
3	MANAGE USERS	
3.1	The admin shall be able to add, view and delete the user profile.	MANDATORY
3.2	The system shall be able to allow the user to click the menu “MANAGE USERS” rendered from the menu of the website.	DESIRABLE
4	MANAGE WORKSHOP	
4.1	The admin shall be able to add workshop information on the form provided.	MANDATORY
4.2	The system shall be able to allow user to click menu “Add Workshop Info” rendered from “MANAGE WORKSOP” dropdown menu	DESIRABLE
4.3	The user shall be able to fill in workshop information such as name, address, on the form given on the system.	DESIRABLE
4.4	The admin shall be able to click “Submit” on the car form	DESIRABLE
4.5	The system shall be able to store the workshop information on the database.	DESIRABLE
4.6	The system shall be able to display stored workshop information to the admin.	DESIRABLE

The list of requirements shown in Table 1 and Table 2 were visualized and modeled using Unified Modelling Language (UML). The web-based system's structural components displayed using a Use Case Diagram. Use case diagram was drawn using StarUML. Figure 2 and Figure 3 represents the use case diagram and the relationship

between different use cases and the actors of a web-based system that can be used to record and manage auto service activities at local mechanic shops. The use case diagrams display for two actors of the system; Vehicle owner and Admin.

As shown in Figure 2, registration, login, manage user profile, manage vehicle information, manage reminders, search location, and view history are the seven key use cases for vehicle owners. While, login, manage users, and manage workshop information are three key use cases for admin, as depicted in Figure 3.

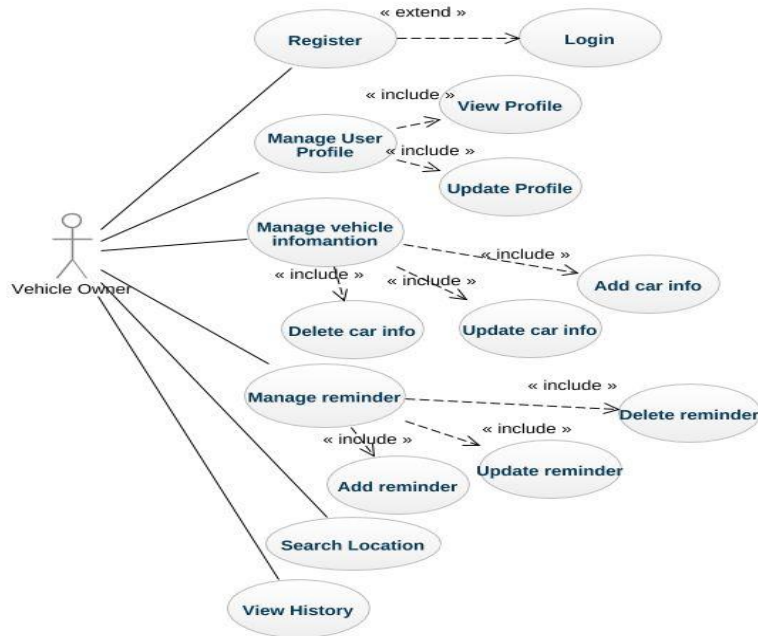


FIGURE 2. The use case diagram of vehicle owner module

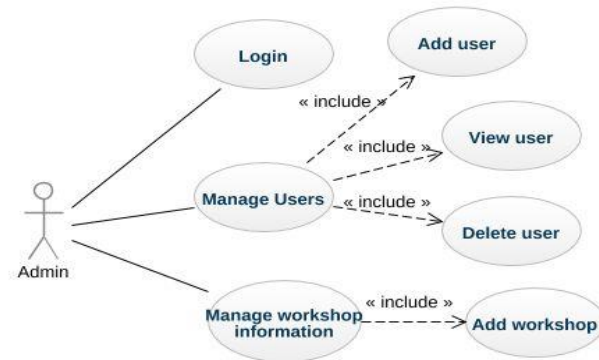


FIGURE 3. The use case diagram of admin module

Prototype development of Automobile Service E-Assistant

The Automobile Service E-Assistant website is a prototype of a web-based system for recording and tracking auto service activities. The Automobile Service E-Assistant was installed on a local host using an Apache server to evaluate its efficiency and collect feedback from users while they interacted with the prototype. The screenshots below demonstrate some of the Automobile Service E-Assistant website's interfaces.

1) Register form

To enter the system, each user must register into the system by entering details as illustrated in Figure 4.

2) Login form

To gain access to the system, vehicle owner and admin must enter username and password, then select the user type as illustrated in Figure 5.

FIGURE 4. Registration Form

FIGURE 5. Login Form

3) Car info form

After entering the system, the user can fill in details of the car such as car brand, model, plate number and fuel type before setting a reminder as depicted in Figure 6.

4) E-Reminder form

The “E-Reminder” interface as shown in Figure 7 enables user to set and manage reminder. User can set reminder by selecting the workshop name and picking a date from the date picker for auto service activities.

5) Service Locator

The “Service Locator” interface as shown in Figure 8 enables the user to select state and city and display the nearby workshop information for related search.

6) Manage profile information

The User can view and update the profile information as illustrated in Figure 9.

7) View History

The system enables user to view past history of auto service activities as shown in Figure 10 and 11.

FIGURE 6. Car Info Form

FIGURE 7. E-Reminder Form

Workshop Name	Address	Phone number
New Way Motor Workshop Sdn. Bhd.	3, Jalan Senoja 47, Johor Jaya, 81100	07-3535003

FIGURE 8. Service Locator

Fullname:	chitramgill raman
Email:	chitramgill@gmail.com
Phone Number:	0164661754
Address:	No 30, Jalan Hamzah Alang 8, Taman Kapar Rai 4
Edit	

FIGURE 9. User Profile

Next Service Date	Battery Change Date	Tyre Change Date	Oil Filter Due	Coolant Expiration Date	Oil Type/Grade	Mileage of Next Service	View Details	Edit	Delete
2020-05-18	2020-05-18	2020-05-14	2020-05-20	2020-05-20	SEMI SYNTHETIC 5W-30	120000KM			

FIGURE 10. View History

Workshop Name:	Jet Cheng Auto Services
Next service date:	2020-05-18
Battery Change Date:	2020-05-18
Tyre Change Date:	2020-05-14
Oil Filter Due:	2020-05-20
Coolant Expiration Date:	2020-05-20
Oil Type/Grade:	SEMI SYNTHETIC 5W-30
Mileage of next service:	120000KM
Others Service done on Vehicle:	air filter change

FIGURE 11. View Service Details

EVALUATION AND FINDINGS

Evaluation Setting

Thirty people were asked to participate in a usability test. A simple random sample procedure was used to select the car owners as responders. The Automobile Service E-Assistant website and a post-task questionnaire were utilised as evaluation tools. This post-task questionnaire was derived from the 20-item Website Analysis and MeasureMent Inventory (WAMMI) questionnaire. The questionnaire is divided into two sections. The study's demographic background is presented first, followed by respondents' feedback on the Automobile Service E-Assistant measure, which is measured on a five-point likert scale ranging from "strongly disagree = 1" to "strongly agree = 5."

The following steps are performed by respondents for the evaluation:

- 1) Read and signed consent form
- 2) Use the Automobile Service E-Assistant website
- 3) Answer the post-task questionnaire

The Respondents' Demographic Background

From a total of 30 responses, 53.3 percent are male and 46.7 percent are female. The majority of responders (46.7 percent) were between the ages of 26 and 35. They were all vehicle owners where 73.3 percent had one car, and the rest had two cars. The majority of respondents (73.3%) said they had never used any apps or websites for their cars, while the rest said they had used specific apps or websites to manage their auto servicing activities.

The majority of respondents had never heard of electronic-assistant, with only 33.3 percent saying they had. 70 percent of respondents chose service reminder sticker as their technique of remembering next service activities, and the rest 30 percent chose car service record book.

When asked how many times they service their car per year, 36.7 percent said they service their car once a year, 60 percent said they service their car twice a year, and just 3.3 percent said they service their car more than three times a year. When it comes to vehicle service, the majority of respondents (60%) service their cars at local mechanic shops, while only 20% service their cars at Authorized Service Centers.

The Usability of Automobile Service E-Assistant

The replies were analyzed, and the respondents' perception toward Automobile Service E-Assistant were measured in terms of attractiveness, controllability, efficiency, helpfulness, and learnability. Table 3 shows the website's usability in terms of attractiveness from the standpoint of car owners. The findings demonstrate that the majority of respondents perceive the website to be extremely fascinating, and that the website's pages are very appealing. Only a few people are unsure whether or not they want to use the website. This means that the website's functionality and appearance are still in need of improvement. The website also need more appealing elements on its pages in order to encourage users to surf the site and maximize its utilization.

TABLE 3. The Respondents' Responses on the Attractiveness of Automobile Service E-Assistant

Attractiveness	1	2	3	4	5
Automobile Service E-Assistant website has much that is of interest to me	0	0	0	6 (20%)	24 (80%)
The pages Automobile Service E-Assistant website are very attractive	0	0	0	9 (30%)	21 (70%)
I don't like using Automobile Service E-Assistant website	20 (67%)	8 (27%)	2 (6%)	0	0
Using Automobile Service E-Assistant website is a waste of time	18 (60%)	10 (33%)	2 (7%)	0	0

Table 4 shows the website's usability in terms of controllability from the standpoint of car owners. The results demonstrate that most respondents can access what they want quickly by clicking buttons on the website. They can also choose what they wish to see on the site. On the website, users can easily contact the persons they wish. However, few people believe that navigating the website is challenging. This is due to the fact that this website has a linearized forgot password page. When consumers click on a link to this page in an email, they are taken to an entirely other page, where they are uninformed of the page's structure and find it difficult to navigate. This page should integrate into a single page so that it does not lead to a new web page in the same browser.

TABLE 4. The Respondents' Responses on the Controllability of Automobile Service E-Assistant

Controllability	1	2	3	4	5
It is difficult to move around Automobile Service E-Assistant website.	16 (53%)	9 (30%)	0	2 (7%)	3 (10%)

I can quickly find what I want on Automobile Service E-Assistant website.	0	0	1 (3%)	9 (30%)	20 (67%)
I feel in control when I am using the Automobile Service E-Assistant website.	0	0	1 (3)	8 (27)	21 (70%)
I can easily contact the people on the Automobile Service E-Assistant website.	0	0	1 (3%)	9 (30%)	20 (67%)

Table 5 shows the website's usefulness in terms of efficiency from the standpoint of car owners. The findings demonstrate that the majority of respondents perceive the Automobile Service E-Assistant website to be efficient, and that they obtain what they expect when they click on the website's items. They can also conveniently organize information about auto servicing activities. It reveals which users are the most satisfied with the website's efficiency.

TABLE 5. The Respondents' Responses on the Efficiency of Automobile Service E-Assistant

Efficiency	1	2	3	4	5
Automobile Service E-Assistant website is too slow.	17 (57%)	13 (43%)	0	0	0
I feel efficient when I'm using the Automobile Service E-Assistant website.	0	0	0	6 (20%)	24 (80%)
It is difficult to tell if Automobile Service E-Assistant website has what I want.	16 (53%)	14 (47%)	0	0	0
I get what I expect when I click on things on the Automobile Service E-Assistant website.	0	0	0	6 (20%)	24 (80%)
Using this website, I can manage my auto service information efficiently.	0	0	0	5 (17%)	25 (83%)

Table 6 shows the website's usability in terms of helpfulness from the standpoint of car owners. The results suggest that the majority of respondents think the website is logical for them and that it is simple to use. The majority of customers also feel that the website keeps them informed about auto service activities performed on their vehicle and makes it simple to identify nearby local workshops. Several people said that this website needs an introduction before it can be used.

This indicates that the website requires powerful and captivating introduction content as well as clear instructions on how to utilise the website in order for users to stay on the site. A few people are likewise unconcerned with the website function. Unnecessary features should be avoided, and existing features should be modified to boost user interest in the website.

TABLE 6. The Respondents' Responses on the Helpfulness of Automobile Service E-Assistant

Helpfulness	1	2	3	4	5
Automobile Service E-Assistant website seems logical to me.	0	0	0	8 (27%)	22 (73%)
Automobile Service E-Assistant website needs more introductory explanations.	10 (33%)	10 (33%)	2 (7%)	2 (7%)	6 (20%)
Automobile Service E-Assistant website helps me find what I am looking for.	0	0	0	6 (20%)	24 (80%)
Automobile Service E-Assistant website has some annoying features.	20 (67%)	6 (20%)	4 (13%)	0	0
Using this website, I can remember when I need to service my vehicle.	0	0	0	2 (7%)	28 (93%)

Automobile Service E-Assistant website keeps me up to date with my next auto service activities.	0	0	0	5 (17%)	25 (83%)
Automobile Service E-Assistant website located me with the nearby mechanic shops easily.	0	0	0	8 (27%)	22 (73%)

In terms of learnability, Table 7 depicts the website's usefulness from the standpoint of car owners. The results suggest that the majority of respondents find it simple to navigate the website. This website is also easy to navigate for newcomers. They also have a good memory for where they are on the site. It demonstrates that the website is simple to navigate.

TABLE 7. The Respondents' Responses on the Learnability of Automobile Service E-Assistant

Learnability	1	2	3	4	5
Learning to find my way around Automobile Service E-Assistant website is a problem	15 (50%)	15 (50%)	0	0	0
Using the Automobile Service E-Assistant website for the first time is easy.	0	0	0	5 (17%)	25 (83%)
Remembering where I am on the Automobile Service E-Assistant website is difficult.	16 (53%)	14 (47%)	0	0	0
Everything on the Automobile Service E-Assistant website is easy to understand.	0	0	1 (3%)	4 (13%)	25 (83%)

These results also suggest that the Automobile Service E-Assistant website is a beneficial tool for vehicle owners to keep track of their auto service operations. Vehicle owners can also quickly identify local mechanic shops using this website. Furthermore, visitors like the website because of its attractiveness, controllability, efficiency, helpfulness, and learnability.

CONCLUSION

The design and implementation of a web-based reminder system for tracking and managing car service activities were discussed in this paper. The results of this study show that the reminder system is an important tool for car owners. Automobile Service E-Assistant, the suggested system, has demonstrated its ability to function as a support and assistive tool for automobile owners.

In the future, the mechanic, in addition to the automobile owner, may be invited to participate in the study and provide feedback and opinions. In terms of the platform, we intend to combine a web-based system and a mobile app to make data administration easier and more accessible. In addition to using an email system to send a reminder, automatic SMS notifications may be utilized to tell vehicle owners about upcoming auto service activities, and a rating system can be integrated to allow car owners to review local mechanics' service. Finally, an Artificial Intelligence (AI) algorithm can be added into the system as a diagnostics and support system to assist automobile owners in troubleshooting their vehicles during breakdowns and recommending the best solution. For example, AI systems using neural networks (Ishak et al., 2011) and fuzzy logic (Mokhtar et al., 2016) have demonstrated their ability to assist humans in making decisions.

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