

# **Development of a Time Mapping Software Application for Improving Productivity in an Automotive Workshop**

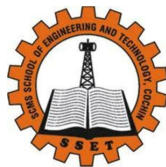
A PROJECT REPORT

Submitted by

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**to**

the A P J Abdul Kalam Technological University  
in partial fulfillment of the requirements for the award of the Degree  
of  
Bachelor of Technology  
In  
Mechanical Engineering



**DEPARTMENT OF MECHANICAL ENGINEERING**  
SCMS SCHOOL OF ENGINEERING AND TECHNOLOGY  
KARUKUTTY  
JUNE 2022

## **DECLARATION**

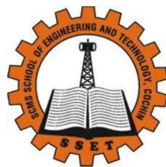
I undersigned hereby declare that the project report “Development of a Time Mapping Software Application for Improving Productivity in an Automotive Workshop”, submitted for partial fulfillment of the requirements for the award of degree of Bachelor of Technology of the APJ Abdul Kalam Technological University, Kerala is a bonafide work done by me under supervision of DR.Manikandan H, Assistant Professor, Department of Mechanical Engineering, SCMS School of Engineering and Technology. This submission represents my ideas in my own words and where ideas or words of others have been included, I have adequately and accurately cited and referenced the original sources. I also declare that I have adhered to ethics of academic honesty and integrity and have not misrepresented or fabricated any data or idea or fact or source in my submission. I understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not been previously formed the basis for the award of any degree, diploma or similar title of any other University.

Place: Karukutty

Date: 03.06.2022

RENISH SUNNY

**DEPARTMENT OF MECHANICAL ENGINEERING**  
**SCMS SCHOOL OF ENGINEERING AND TECHNOLOGY**  
**KARUKUTTY**  
**2021-2022**



**CERTIFICATE**

This is to certify that the report entitled **Development of a Time Mapping Software Application for Improving Productivity in an Automotive Workshop** submitted by **RENISH SUNNY, Reg No.SCM18ME063**, to the APJ Abdul Kalam Technological University in partial fulfillment of the B.Tech degree in Mechanical Engineering is a bonafide record of the project work carried out by him under my guidance and supervision. This report in any form has not been submitted to any other University or Institute for any purpose.

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Finally I thank my parents, all my friends, near and dear ones who directly and indirectly contribute to the success of this work.

**RENISH SUNNY**

## **Abstract**

In the present world, servicing of vehicles in automotive workshop takes more time due to unnecessary idle time. Customers are the God of any industry but delay in getting vehicles which may lead to decrease in productivity in service makes a bad impression to the customers. A preliminary literature survey has been conducted in the domain at various topics like improvement of productivity in automotive sector, Work and time study, Scheduling and routing in industrial floors, time management in flow lines. In the service centers when the customers give their cars for servicing there is a time lag in most of the service centers. A single day work gets postponed to 2 to 3 days which causes a bad reputation to their respective service centers. But there is a method to diagnose this which is collectively known as time mapping technique. Time mapping helps to identify where the time is delayed. This time mapping is used in car washes, reception, car repairs and other sections. This time mapping is planned to implement by generating a QR code as well as a QR code scanner which scans the QR code placed on the automobiles which requires servicing or repairing in the present work. For each car a unique QR code is placed on the car so there will be no confusion when servicing. These QR codes are generated as well as scanned by a particular or a single proposed application. After servicing of the automobile the QR code is removed and time taken will be noted down. So it can be found out whether the service took excess time or not. The QR code is supposed to be pasted from the entry. The time is mapped on an excel sheet so that the management can directly monitor and find out the time lag during the service when the QR code is scanned. So the conclusion is that this could be a huge enhancer in the automobile industries.

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# Chapter 1

## INTRODUCTION

In the present world, servicing of vehicles in automotive workshop takes more time due to unnecessary idle time. Customers are the God of any industry but delay in getting vehicles which may lead to decrease in productivity in service makes a bad impression to the customers. A preliminary literature survey has been conducted in the domain at various topics like improvement of productivity in automotive sector, Work and time study, Scheduling and routing in industrial floors, time management in flow lines. In the service centers when the customers give their cars for servicing there is a time lag in most of the service centers. A single day work gets postponed to 2 to 3 days which causes a bad reputation to their respective service centers. But there is a method to diagnose this which is collectively known as time mapping technique. Time mapping helps to identify where the time is delayed. This time mapping is used in car washes, reception, car repairs and other sections. This time mapping is planned to implement by generating a QR code which is scanned by a QR code scanner, which scans the QR code placed on the automobiles which requires servicing or repairing.

# **Chapter 2**

## **LITERATURE SURVEY**

### **2.1 An Application of Value Stream Mapping In Automotive Industry: A Case Study**

Studies on applications of lean in a continuous process industry are limited. There is lot of opportunities for improvement in the process industries like automobile industry if lean tools are utilized. This paper addresses the application of Value Stream Mapping as one of the Lean tools to eliminate waste, and improved operational procedures and productivity. Current state map is prepared and analyzed and suggested to improve the operational process. Accordingly the future state map is drawn. The study reveals that there is an improvement in the takt time by implementing the proposed changes if incorporated in the future state map

### **2.2 Improvement of Service Quality at Automobile Workshop in Bangladesh**

The automobile repairing industry in Bangladesh is growing at a very rapid pace but the quality still doesn't reach to the topmost mark. Due to advancement in vehicle technology

the service requirement of vehicles has also become technology dependent. Demand of highly skilled workers is on the rise. Hence, there is growing demand for organized service retailing. The objective of this paper is to understand the market potentiality, existing condition of automobile repairing business industry, recent problem in automobile servicing business a guideline of quality service. We describe the problems encountered by the client and how the simulation study illuminated a pathway to significant improvements in customer service and financial profitability. To understand the situation of automobile business in Bangladesh , a representative survey of customers, owners of different automobile workshop; technicians involved in this business and spare parts sellers was conducted. A secondary source was collected data from BRTA, automobile industry journal, internet sources; data published from business organization has been used for analyzing the situation. Necessary suggestions have been made and service center has started executing them for the improvement in current service quality level and improve their business performance.

## **2.3 Productivity Improvement in Assembly Line of Automobile Industry by Reducing Cycle time of Operations**

The present study has been done at one of the famous automobile industry, a leader manufacturer of tractors. The aim of study is to identify various problems on the assembly line which are causing assembly line to stop. There are two assembly lines rear assembly line and front assembly line and the work has been done on the front assembly line. The bottle neck problem is found in front assembly line and is solved by reducing the cycle time of the operations by utilizing the work study techniques and material handling techniques and it was found that cycle time of the bottle neck operation was reduced by 14.66 trolley.

## **2.4 Implementation of Lean Tools in an Automotive Industry for Productivity Enhancement - A Case Study**

Value stream mapping has the reputation of uncovering waste in manufacturing, production and business process. This helps in identifying and removing or streamlining value added steps and eliminating non value added steps. In this study the process was analyzed to find an opportunity to drastically reduce the number of actions and to simplify the same. By reducing waste the proportion of value adding time increases in the whole process and the process throughput speed could also be increased. This makes the redesigned process more effective and more efficient. The reengineered process was flow charted in its future state with process steps and information flows re-engineering, simplified and economized. The current layout was analysed to identify and eliminate the non value added activities through lean tools like 5S, VSM and line balancing in a manufacturing industry. From the observed results, it was concluded that the non value added time could be reduced by about 13 percentage while the process cycle efficiency could be increased by about 10 percentage. Virtual simulation was conducted to verify and validate the existing situation as well as to propose the results and the effectiveness of lean principles in a systematic manner with the help of ARENA

## **2.5 Implement Lean Thinking in Automotive Service Centers to Improve Customers' Satisfaction**

In industrialized countries, most of the companies deployed lean manufacturing techniques in order to minimize the wastes and consequently maximize the overall benefits. In the present work, the lean manufacturing techniques are applied in automotive service centers to measure the customers' satisfaction. Moreover, the impacts of such technique on the overall business environment are reevaluated. Results indicate that both the leading time

and take time are significantly reduced by about 69.4 percentage, and 52.0 percentage respectively. In addition, the service center's layouts are improved. Accordingly, the closeness rate of the production department increases and the total distance travelled is reduced. The customer satisfaction index is improved by 74 percentage. The obtained results encourage the industrial companies to use the lean thinking approach in services and production departments in order to greatly enhance the productivity, competitiveness and overcome the industrial obstacles

## **2.6 A Quick Response (QR) Code Generator with Mobile Scan Application for Mobile Network Recharge Operations**

This paper, a Quick Response (QR) Code Generator with Mobile Scan Application for Mobile Network Recharge Operations (GSM Networks) tries to implement a system with an excellent cross platform compatibility. The emergence of the Android Mobile Operating System has brought about a huge change in the smart phone industry. It has contributed to the increase in the range of services which a smart phone can provide. The Quick Response (QR) Code technology can be regarded as a key technology in the future of mobile network operators in the telecommunication industry. This work is to present a model of mobile recharge solutions using the QR Code as the communication link, enabling encryption of transaction details using the python flask framework as well as their ability to be used in the exchange of financial value. The system developed is a new android mobile wallet application which was developed using the object oriented analysis and design methodology. Our experimental result shows that the new system has better security features as it deploys dual authentication.

## **2.7 Android Application Development using Android Studio and PHP Framework**

Today, as we all know that the development of hardware for mobile device is getting better and the performance index is very high than the actual requirements of the software configuration. Phone's features are now more dependent on software or application. This paper describes development of Android mobile platform application. Development environment of Windows Mobile and Apple's iPhone are very simplified for mobile applications. Mobile applications give users a quick and reliable user experience. Primary focus of this paper is on the Android architecture based on Linux version 2.6. It is Linux based an open-source mobile phone operating system. Basically Java programming language is used to develop android application. Android SDK provides set of application programming interfaces (APIs) and Android Studio Platform that can be used to create applications.

## **2.8 Improvement On Service Quality Of Automobile Service Center**

For an organization customer satisfaction is very important factor. The main aim of this research is measured after sales service performance of the Automobile service center to increase the satisfaction level of customers. In this research, preventive maintenance service of 100-110cc Bike segments in an automobile dealership have been considered for increased satisfaction level of customers. This research uses SERVQUAL model to measure satisfaction level of the customers linked with Quality Function Deployment to translate Voice of the Customers into Technical Requirements and House of Quality is used to compare the Voice of Customers with the Technical Requirements to determine their respective relationships for Service Quality improvement. Improvement on Service quality in the automobile sector on 100-110cc Bike Segments are not constantly practiced. In the current situation the demand of 100-110cc bike is higher so service quality is extremely

important. To achieve higher customer satisfaction level, we will have to provide excellent quality as well as high grade preventive maintenance services



# Chapter 3

## METHODOLOGY

The solution for the idle time problem is through a time mapping software. Through this software, the flow of an automobile from the gate in to delivery is digitally recorded. With this software a unique QR code is to be generated for every vehicle arriving for the service at the gate. The method suggests pasting this QR on the vehicle at the gate in and this QR is scanned before entering to every particular job in the service of the vehicle. By scanning this QR the time is mapped on the back end database, so that the management can directly find out the time spent by each department during the service. By this they can understand the problem behind time lag and find out which respective job has taken more time during the service hours lively. So they can take appropriate measures to avoid this and it will definitely increase the productivity in an automotive workshop.

There are lot of opportunities for improvement in the automotive industry if the work productivity of the employees is improved. Being productive at work can be difficult, especially if there is no way to monitor your work. Most employees tend to waste some time during work. Cameras can be mounted on the workspace to monitor the actions of employees. It is not comprehensive and will not provide work specific monitoring. Although cameras create a psychological block of being watched. But it will require a lot of effort and time to monitor every single employee through cameras. Even though the service centers have enough potential to finish the work faster, the work gets delayed due to idle

time wasting. This problem can be solved with the help of time mapping application. This app will reduce the effort and time required to monitor each and every employee in the workplace and also improve the work efficiency.

### CURRENT WORK FLOW

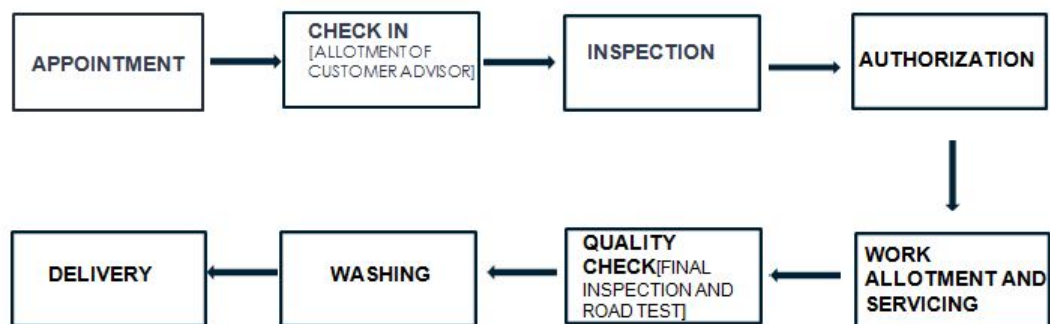


Figure 3.1: current work flow

Areas where the work flow could improve

- (1) Difficult to track technician efficiency
- (2) Difficult to find current status of a vehicle
- (3) Difficult to find the idle time wasted
- (4) How to identify good workers

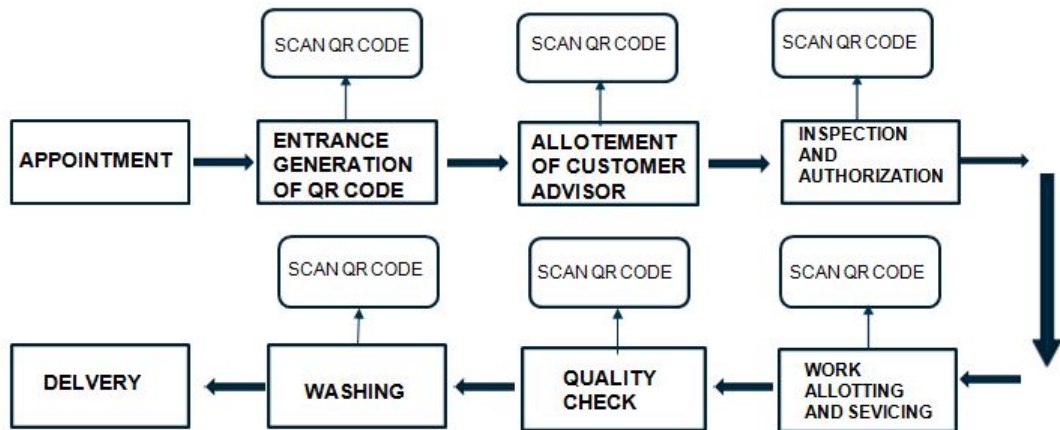


Figure 3.2: suggested work flow

## 3.1 DIFFERENT JOB POSITIONS

### Service Cashier

The service cashier carries out some very important functions in the service operation.

The general responsibilities of the service cashier are to

- Review and calculate the service invoice
- Notify customers once the repairs are completed
- Maintain a filing system for paperwork
- Greet the customers when they arrive to pick up their vehicles
- Process payment for the repairs
- Provide the customer with copies of service records and a receipt for payment

The service cashier is extremely important to the success of the service operation. The cashier has face to face contact with customers. Therefore the impression of professionalism and caring that the cashier leaves with the customer strongly influences the impression the customer has of the entire service organization.

## **Dispatcher**

The dispatcher is the one who manages the daily workflow in the shop and is responsible for the distribution of work throughout the shop. In a typical shop environment the repair orders, when written up by the service advisors, are forwarded to the dispatcher. The dispatcher is held accountable to know what work has been promised, the number of technicians available and the skills they possess, and the available amount of time each technician has available. Ultimately, he is responsible to get all the work out correctly and on time every day. The dispatcher's ability to assign the right work to the right people at the right time has a profound impact on the productivity of the shop and of the individual technicians.

## **Claims Administrator (Booker)**

The claims administrator is responsible for evaluating the repair order and determining what the technician should be paid for the repairs. In some organizations the term "booker" is used as the description of this job because the primary task of a claims administrator is to evaluate the repairs done and pay the technician by making out a pay slip that goes on the technician's weekly payroll record (book). Automotive repair shops depend upon independent authorities to provide them with books of labor standards time guides that they can use to make sure that they are charging the customers a fair and consistent price for a needed or requested repair. This ensures that the customer is charged a fee that is related to the actual time that the repair will take and is comparable to what other customers will be charged there or at another competitive shop in the area.

## **Shop Foreman**

The shop foreman is the on-the-field coordinator of the day-to-day activities in the repair shop. The foreman works with the technicians in the shop, assisting them with diagnosis of difficult problems. He provides guidance and additional brainpower and a second set of hands to assist experienced technicians. He provides on-the-job training for younger, less

experienced technicians. The foreman works with service advisors to help verify and pinpoint the cause of customer complaints to assist them in developing a reasonable estimate of the cost of repairs. He often is actively involved in the most difficult technical problems that the others in the shop are unable to resolve. Overall, he assists in the coordination of the resources in the shop to keep repairs moving and ensure that employees are productive. Finally, in many cases, he is responsible for double-checking repairs before a car is returned to the customer to verify (quality check) that the repairs have been completed correctly

### **Service Advisor**

The service advisor is the front line employee and the face of the company in the automotive service shop. He is the one that the customer contacts and works most directly with throughout the repair process. He is the company in the eyes of the customer. The service advisor's major job responsibilities are to

- Respond to customer inquiries on the telephone, online, and in person
- Schedule appointments based on the availability of resources to perform the repairs
- Write up repair orders to accurately reflect the customers' concerns and requests
- Perform general diagnosis of complaints through observation and questioning
- Recommend needed services to customer based on time, mileage, and observation
- Prepare accurate repair estimates and obtain customer approval to proceed with repairs
- Notify the customer of repair progress
- Verify the completion and accuracy of repairs and bills

### **Lead Technician**

The lead technician is the normally the most qualified master technician in the shop.

In a team or support group shop, the person in this position may also be referred to as the "team leader." He typically works with two sets of responsibilities: resolving the most difficult problems and guiding and directing others within his work group to efficiently resolve the more simple problems

### **Skills and Abilities Required**

The lead technician must possess a great deal of technical expertise. He also generally has extensive industry experience that gives him real-life knowledge to complement his theoretical understanding of the principles and practices of automotive repair. Further, the lead technician is typically the most heavily trained individual in the shop, having been selected to attend and pass most of the update training seminars supported by the repair shop or manufacturer. A high level of knowledge and skills are essential to be a lead technician, but unless he is capable of sharing that knowledge with others, he is ineffective. He needs to be a leader. He needs to lead the team by setting an example of dedication and high work standards. He also needs to have the ability and willingness to help provide local training to fellow employees that will improve their productivity and that of the entire organization.

## **Porter**

Although the responsibilities of a service porter may vary from shop to shop, the service porter is typically responsible for performing tasks such as

- Shuttling customer vehicles from the service write-up area back to the storage lot
- Providing rides to customers to get them to work or home while their car is being repaired and bringing them back to the shop once the repairs are completed
- Cleaning and/or detailing customer vehicles after repairs and new vehicles before retail delivery
- Shuttling customer vehicles back to the service pick-up area from the storage lot when the customer arrives to pick up the vehicle
- Running errands to pick up customers, parts, tools, and equipment as needed to support the overall flow of work in the shop
- Doing miscellaneous chores around the shop, including housekeeping duties

## **Parts Specialist**

Although not all shops have an internal parts department, all automotive service shops need to have access to parts to perform many common repairs and, therefore, often employ a parts specialist. The function of the parts specialist is to assist in identifying what parts are needed to perform the repairs for a specific application and to have them available in a timely manner. Without accurate identification of the right part and availability at the right time, the amount of delays that are likely to occur will cost the shop profit and, very likely result in the loss of many customers.

## **Technician**

The primary responsibility of the service technicians is to perform specific diagnosis to verify the complaint and pinpoint the cause. Based on this information he is responsible for developing an estimate of cost and time needed to resolve the concerns.

Upon receiving approval, he performs the necessary repairs, verifies that the work completed has resolved the customer concerns, produces a detailed written record of what was done on the vehicle, and makes sure that the vehicle is returned to its original condition of cleanliness. Further, because of the rapid and constantly changing technology in the automotive industry, technicians are expected to attend annual training provided by manufacturers, tool and equipment providers, and outside training organizations to maintain knowledge of current and emerging vehicle systems.

## **Customer Relations Specialist**

Customer satisfaction is a key to repeat sales and the ultimate success of any service operation. Therefore, many service shops contact customers after a service visit to ensure that they had a satisfactory experience and to identify and resolve any problems. The customer satisfaction specialist will generally contact customers using the telephone. Also, she is likely to occasionally encounter an upset customer who may even be verbally abusive. Therefore, essential skills for an individual in this role are excellent people skills, customer

complaint handling skills, and general telephone etiquette and communication skills.

### **Service Manager**

The service manager is responsible for the smooth coordination of all of the jobs and functions in the repair shop. The automotive service manager is not a specialist; he is required to be a generalist. He is responsible for possessing and exercising a variety of skills that span the entire range of managerial talents and abilities. The service manager's main functions are coordination, motivation, and leadership. He is the head coach, and, in many organizations, upper management expects the service manager to be, in effect, operating his department as a company within a company. He must possess a wide range of skills and abilities to perform a variety of tasks on a daily basis. These tasks include, but are not limited to

- Operational and strategic planning
- General management and leadership
- Financial measurement and analysis
- Organization and time management
- Customer relations and complaint handling
- Employee relations, hiring, discipline, and firing
- Marketing, merchandising, and sales
- Workplace safety and other legal issues

### **Service Director**

The title and responsibilities of service director often only occur in larger repair shops and dealerships. The responsibilities of the service director are, in many ways, similar to that of the service manager. The major difference, however, is in the scope of responsibility. Whereas the service manager is only responsible for one profit center, the service department or repair shop, the service director is responsible for the oversight and operation of



three distinct and very unique profit centers: the service repair shop, the parts department, and the body shop. The knowledge, skills, and abilities of the service director include all those identified for the service manager. He has to do everything the service manager does, but on a larger scale. Finally, he needs to possess the political savvy and discretion to interact with the other directors and supervisors within the organization and with the owners to advocate on behalf of his departments.

## **3.2 COMMON ACTIVITIES IN THE WORKSHOP**

- Drain the engine oil
- Replace the air filter
- Replace the oil filter
- Replace the external fuel filter (if fitted)
- Replace the spark plugs
- Replace the brake fluid
- Check and remove dust from drum brake linings
- Replace the coolant
- Replace the accessories belt and rollers
- Clean and check the air conditioning system
- Check and top up the refrigerant

### **3.2.1 THE OTHER OPERATIONS CARRIED OUT DURING THE SERVICE**

- Anti-corrosion check
- Clean the sunroof system (if fitted)
- Check and lubricate the bonnet lock
- Check the exhaust pipe
- Check the levels, condition and sealing of the hydraulic power-assisted steering circuit

(if fitted)

- Check the levels, condition and sealing of the brake/clutch circuit
- Check the levels, condition and sealing of the sequential gearbox circuits
- Check the presence of the wheel valve caps
- Check the wear of the brake discs and pads
- Check the signaling and exterior/interior lighting
- Check the condition of the windscreen and door mirrors
- Check the wiper blades and screen washer fluid levels
- Check the presence of the airbag and engine compartment labels
- Check the 12 V battery with the test tool
- Check the computers with the diagnostic tool

### **3.3 TOTAL WORKFORCE**

Total no of staff in the workshop including trainee is 52 ,out which there are 12 technicians in total. In the mechanical section there are 9 technician and 1PDI with accesories and in the body shop there are 2 technicians .In the bodyshop section there are 3 denter ,3painter, 3polishers and 3 staffs in the washing section. An average of 20 vehicles arrive this workshop everyday this may vary according to days dapends on the rush in the workshop.

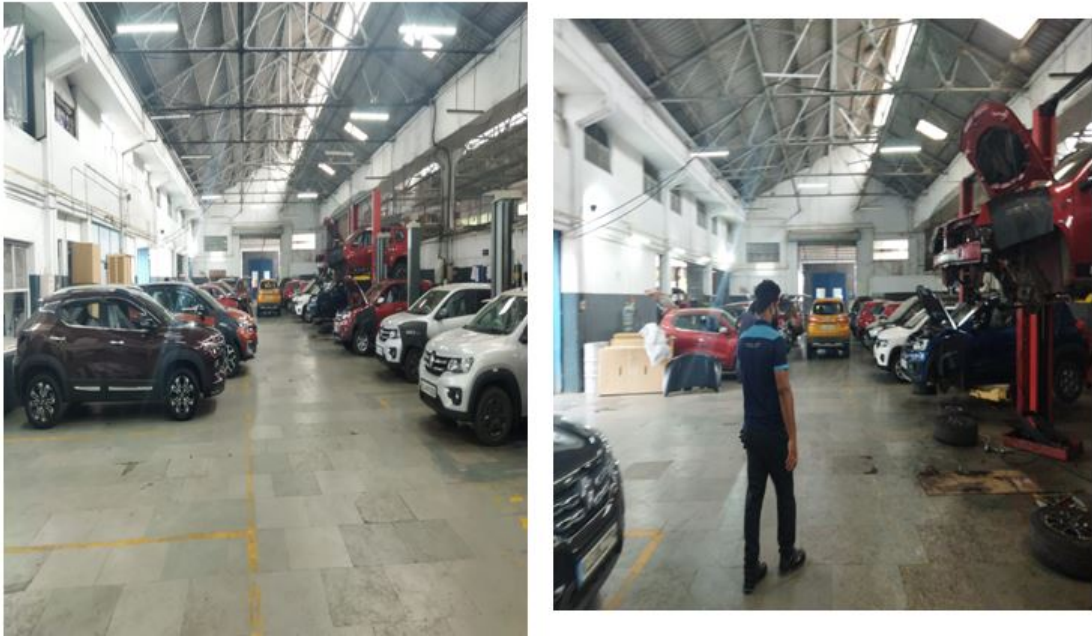


Figure 3.3: workshop images

### 3.4 BODY SHOP WORK FLOW

- Mechanical
- Body alignment
- Denting
- Surface finishing
- Painting
- Polishing
- Final inspection

# Chapter 4

## THE SOFTWARE APPLICATION FOR TIME MAPPING

The software application for the time mapping comes as an android application and a web page for accessing from both android phone and computer by the office staff The android app development is done in the android studio using XML to design the user interface and the java is used for the logic.The server part logic is done in python Django and the front end is created using HTML and CSS

Django is an open-source web framework. A web framework is a piece of software that allows numerous people to work on the same code by breaking it down into smaller pieces, but it should ultimately function as a single unit or code. To put it another way, a framework organises the code. Django is a Python programming language. Django's architecture is known as MVT - Model View Template. The model is used to store information (file,data,name etc). The model is a collection of data on the server. The term "template" refers to a set of pages. View is a function that gives you the tools you need to project a page. This function gets the data it needs from the model and the page it needs from the template, then combines the two to project the page onto the screen. In Django, we must first design all of the required web pages in HTML. HTML (Hyper Text Markup

Language) is the language used to browse web pages. We describe how many pages are required and why these pages are necessary in the URL file. Django will not reply to a user's request for a page if the pages are not given in the URL.

```
##### ADMIN #####
path('admin_login', views.admin_login, name='admin_login'),
path('admin_changepassword', views.admin_changepassword, name='admin_changepassword'),
path('admin_logout', views.admin_logout, name='admin_logout'),
path('admin_home', views.admin_home, name='admin_home'),

path('admin_dept_master_add', views.admin_dept_master_add, name='admin_dept_master_add'),
path('admin_dept_master_edit', views.admin_dept_master_edit, name='admin_dept_master_edit'),
path('admin_dept_master_view', views.admin_dept_master_view, name='admin_dept_master_view'),
path('admin_dept_master_delete', views.admin_dept_master_delete, name='admin_dept_master_delete'),

path('admin_staff_details_add', views.admin_staff_details_add, name='admin_staff_details_add'),
path('admin_staff_details_view', views.admin_staff_details_view, name='admin_staff_details_view'),
path('admin_staff_details_delete', views.admin_staff_details_delete, name='admin_staff_details_delete'),
```

Figure 4.1: URL file

```
def admin_login(request):
    if request.method == 'POST':
        un = request.POST.get('un')
        pwd = request.POST.get('pwd')
        ul = user_login.objects.filter(uname=un, passwd=pwd, u_type='admin')

        if len(ul) == 1:
            request.session['user_name'] = ul[0].uname
            request.session['user_id'] = ul[0].id
            return render(request, './myapp/admin_home.html')
        else:
            msg = 'Invalid Uname or Password !!!'
            context = {'msg':msg}
            return render(request, './myapp/admin_login.html', context)
    else:
        msg = ''
        context = {'msg':msg}
        return render(request, './myapp/admin_login.html', context)
```

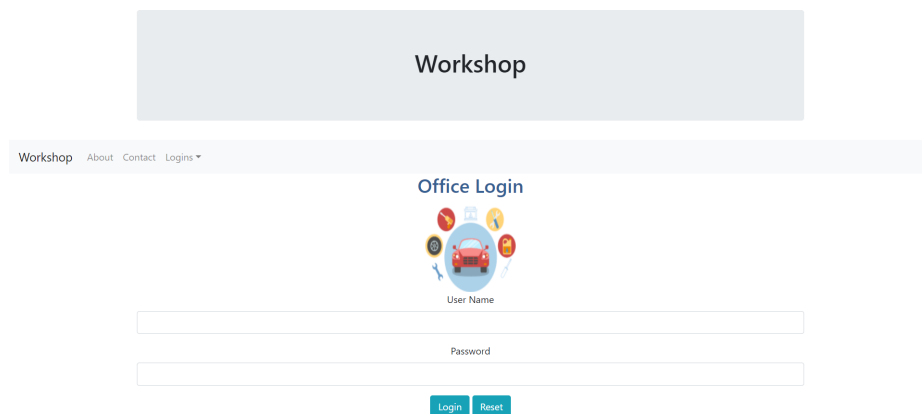
Figure 4.2: URL file

The URL file contains all functions. When the user enters the name of a page, Django

will look it up in the URL. It calls a related view function for that specific name in URL. This function will be executed by Django. The name is the input, and the page is the result. Data administration is made easier by database software, which allows users to store data in an organised format and then access it. It usually features a graphical interface to help users generate and manage data, and in some situations, users can use database software to develop their own databases. Database software enables easier file and record creation, data entry, data editing, updating, and reporting by allowing users to create, read, update, and delete (CRUD) database files and records. Data storage, backup, and reporting, as well as multi-access control and security, are all handled by the software.

Data can be entered into the database, extracted from the database, deleted, and updated. All of this takes place in the view function. Bootstrap is a library of style sheets (CSS). Pages are referred to as activity in Android. Each activity is divided into two parts: XML and Java. As a result, an activity is characterised by the combination of these two. The term "intent" refers to the manner of jumping from one activity to another. XML follows the same basic structure as HTML. XML is similar to a subcategory of HTML. Tag architecture is used in both cases. In HTML, standard tags are utilised, whereas in XML, custom tags are used. In custom tag, we may specify the name of the tags. The layout tag is the initial tag on each page. Each component in the layout is referred to as a view or widget. When we press a button in an Android-powered app. The XML file will be read first. The activity with the term main in it will be the first to be noticed. The app's basic parameters are defined in the manifest file. The manifest will detail all of the activities involved. The login page is the major activity of this app. This is the page that should be displayed first. When we click a button in Java with the help of a URL, the server is contacted. A thread is used to make this connection. Thread is an independent process. It keeps the app from crashing. When the thread is active, it connects to the server, requests a page, and then returns the page. The login handlers are in charge of the page's return. If it is a success, the activities for the various authorities will be displayed. For management login, the manager page will be displayed, for staff login, the staff page will be displayed, and so on for other members. When either the username or password is

incorrect, or both, a failure occurs. A message will be displayed if there is a failure. The camera will be turned on when this page loads. The Google bar code library will also be called. The camera then looks for a QR code. A function will be called if a QR code is recognized. The data is displayed at the top of the screen with this function. We need QR information, so we will call an activity. When the activity launches we will call camera intend. When the camera intend sees barcode it will call a function. In the function we will retrieve the data in the barcode. Then we will show the provision to enter remarks if closing else it will be redirected to job entry.



The image shows a web application interface for a 'Workshop'. At the top, there is a light blue header bar with the word 'Workshop' in the center. Below this is a navigation bar with links: 'Workshop', 'About', 'Contact', and 'Logins' with a dropdown arrow. The main content area is titled 'Office Login' in blue. Below the title is a circular logo featuring a red car in the center, surrounded by various icons representing different services or tools. Under the logo, there are two input fields: 'User Name' and 'Password'. At the bottom of the login section, there are two buttons: 'Login' and 'Reset'.

Figure 4.3: login user interface

This is login user interface of the web page. Here login option is present. Admin, Manager and staff login is possible through web server. admin login can add staff details to the database.

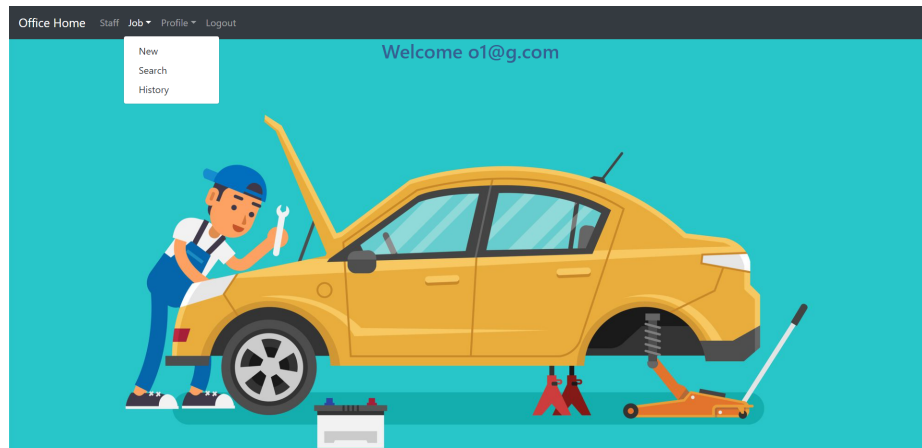


Figure 4.4: Home page office staff

This is the home page of the web page ,here the new job registration , search option and history options are available

Staff Details				
Sl.No	Name	Department	Email	Contact
1	OFirst OLast	Office	o1@g.com	11
2	MFirst MLast	Manager	m1@g.com	22
3	WFirst WLast	Workshop	w1@g.com	33
4	BFirst BLast	Body and Paint	b1@g.com	44
5	Sfirst SLast	Water Service	s1@g.com	55
6	midhun mukum	Manager	k@g.com	7898

Figure 4.5: staff details user interface

The admin can add staff details to the database through admin login.The admin can also delete the staff details . According to this staff details the access to app works. the manager can have the access to the complete database about the vehicle while the worker only have the access to new job entry and job exit



Office Home
Staff
Job
Profile
Logout

### New Job Registration

Reg No  
KL00AA0000

Contact  
Enter contact

Email  
Enter email id

Remarks

Register
Reset

Figure 4.6: job registration page

This is the job registration page in the web server side . The Qr code is generated by registering in this page by entering the vehicle number and other details





Job Details											
Sl.No	Qr	Job Card	Reg No	Email	Contact	Remarks	Staff	Status	In Date/Time	Out Date/Time	Action
1		9	kl08aa0000	u13@g.com	66	none	OFirst OLast	open	2022-04-12 / 12:24:57	/	Close Details
2		12	KL07ZX4789	rsk@g.com	098765432	hello	OFirst OLast	open	2022-04-21 / 11:40:50	/	Close Details
3		13	KL07ZX4789	rsk1@g.com	0987654320	hello	OFirst OLast	open	2022-04-21 / 11:51:13	/	Close Details
4		14	KL06AZ0000	tkk@g.com	987652341	okay	OFirst OLast	open	2022-04-21 / 12:12:05	/	Close Details

Figure 4.7: Job details page

This page is the job details page of different vehicles. Here all details including status of the vehicle is available

Office Home
Staff
Job
Profile
Logout

Search Job

Reg No

KL00AA0000

SearchReset

Figure 4.8: Job search page

This is the job search page here we can search the data about the vehicle using the vehicle number

Job Details											
Sl.No	Qr	Job Card	Reg No	Email	Contact	Remarks	Staff	Status	In Date/Time	Out Date/Time	Action
1		4	KL07AA0000	u1@g.com	123456	regular service	OFirst OLast	close	2022-04-11 / 10:12:38	2022-04-11 / 11:49:46	<a href="#">Details</a>
2		5	KL07AB0000	u2@g.com	1234	10000 km service	OFirst OLast	close	2022-04-11 / 10:12:31	2022-04-11 / 12:26:52	<a href="#">Details</a>
3		6	KL01AB0022	u3@g.com	4444	3rd service	OFirst OLast	close	2022-04-11 / 17:08:13	2022-04-11 / 17:11:12	<a href="#">Details</a>
4		7	KL01CC0000	u11@g.com	123456	no	OFirst OLast	close	2022-04-12 / 12:11:31	2022-04-12 / 13:17:50	<a href="#">Details</a>

Figure 4.9: Job details page

This page is the job details page of specific vehicle. Here all details including status of the vehicle is available. This page gives us the information about the vehicle's workflow, total time taken, time taken by each department, time lag between the work hours can be calculated using this page

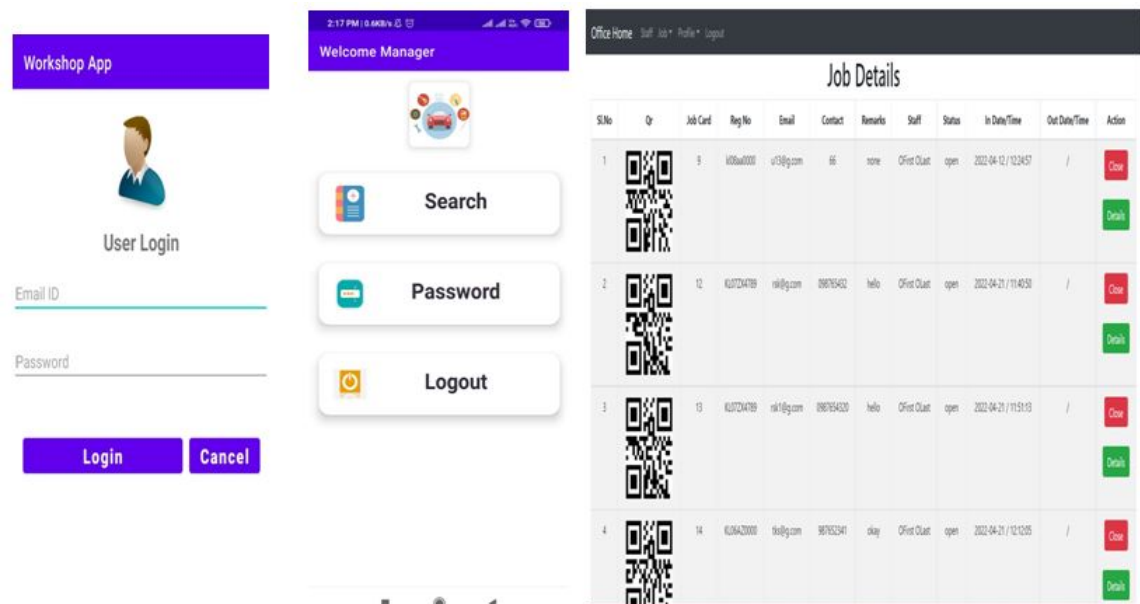


Figure 4.10: User interface of app

This is the user interface of the app in the manager side. Here login, search job, job details are provided

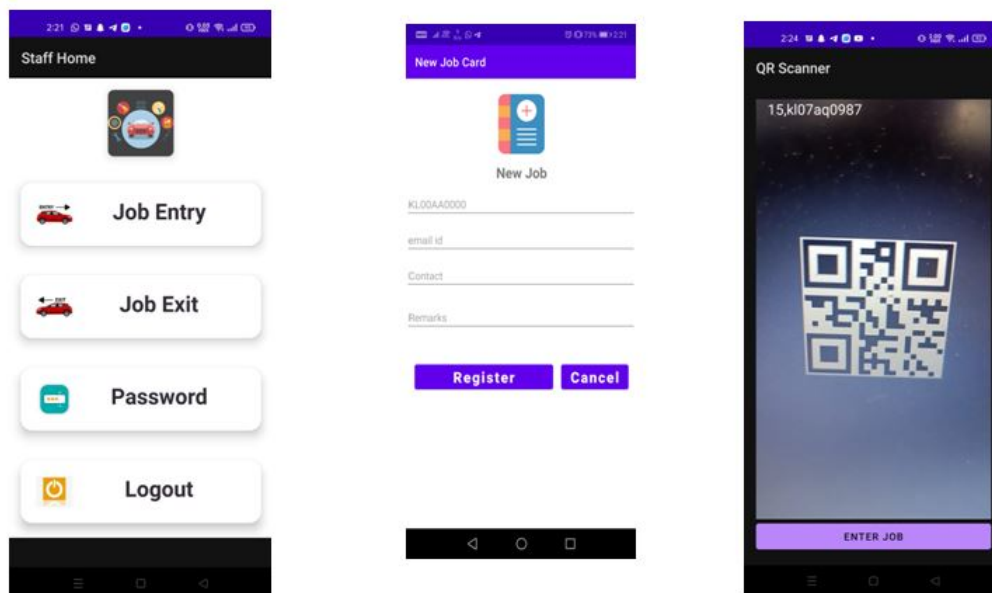


Figure 4.11: User interface of app

This is the user interface of the app in the worker side. Here new job registration , job entry and job exit using Qr code scanner options are provided. On scanning this Qr job entry and exit of the vehicle is mapped to backend database . This database is only accessible for manager and the selected staffs . The staff details data base is managed by the admin login and the admin login decides who can access database about the vehicle and who can add job and exit job by scanning Qr code

# Chapter 5

## WORK MEASUREMENT

Work measurement can be defined as the implementation of a series of techniques which are designed to find out the work content, of a particular task or activity, by ascertaining the actual amount of time necessary for a qualified worker, to perform the task, at a predetermined performance level.

The essence of work measurement is ascertaining the work content of the particular activity under consideration. It helps in:

Evaluating worker's effectiveness, Making comparison between two methods, Developing labour standards, for planning and controlling operations. The estimated time, needed by a qualified worker for carrying out the task, at a normal rate, is known as the standard time. The standard time acts as a benchmark for productivity. Divide jobs into elements. Observe and record each element, any of the work measurement techniques. Set up unit time values, by extending observed time into normal time for each unit. This can be done by applying rating factor. Evaluate relaxation allowance and add the same to the normal time, for each element to get the work content. Ascertain the frequency of occurrence of each element in the job, then multiply the work content to it. After that total the times to reach the work content of the job. Add contingency allowance, wherever required, to get the standard time for performing the job.

For the work measurement we take four car's third service as a case study and mapped its

time from gate in to gate out .For that we take renault kwid's third service and its full work flow is monitored with the app and this time is mapped along its work flow from the gate in to gate out .With this app we can monitor the time taken for each operations , we find out the idle time between the operations and the efficiency of the worker. The management can directly monitor the work from anywhere by using this software application.

## TIME MAPPED DURING THE SERVICE OF KL45L4334 USING APPLICATION

Manager Home   Staff   Job   Profile   Logout								
Job Details								
Sl.No	Reg No	Department	Staff	Status	In Date/Time	Out Date/Time	Remarks	Total Time
1	KL45L4334	WORKSHOP	SECURITY	CLOSE	2022-04-14/10:6:11	2022-04-14/17:30:25	IN AND OUT TIME	7hr 24min 14sec
2	KL45L4334	WORKSHOP	CRE	CLOSE	2022-04-14/10:8:22	2022-04-14/10:15:13	CUSTOMER ADVISORY IS ALLOTTED	6min 51sec
3	KL45L4334	WORKSHOP	CA	CLOSE	2022-04-14/10:18:41	2022-04-14/10:38:17	WORK ALLOTTED TO FC	19min 36sec
4	KL45L4334	WORKSHOP	TECHNICIAN	CLOSE	2022-04-14/10:39:51	2022-04-14/11:16:02	INSPECTION	36min 11sec
5	KL45L4334	WORKSHOP	TECHNICIAN	CLOSE	2022-04-14/11:18:16	2022-04-14/11:53:14	ENGINE OIL AND ENGINE OIL FILTER REPLACEMENT	34min 58sec
6	KL45L4334	WORKSHOP	TECHNICIAN	CLOSE	2022-04-14/11:55:19	2022-04-14/13:02:55	OP & SP GASKET REPLACEMENT	1hr 7min 36sec
7	KL45L4334	WORKSHOP	TECHNICIAN	CLOSE	2022-04-14/13:04:06	2022-04-14/13:48:47	SPARK PLUG CLEANING	44min 41sec
8	KL45L4334	WORKSHOP	TECHNICIAN	CLOSE	2022-04-14/13:50:02	2022-04-14/14:16:25	COOLING SYSTEM INSPECTION	26min 23sec
9	KL45L4334	WORKSHOP	TECHNICIAN	CLOSE	2022-04-14/14:17:29	2022-04-14/14:33:28	FUEL SYSTEM INSPECTION	15min 59sec
10	KL45L4334	WORKSHOP	TECHNICIAN	CLOSE	2022-04-14/14:34:57	2022-04-14/14:41:08	FUEL SYSTEM CLEANING	23min 39sec
11	KL45L4334	WORKSHOP	TECHNICIAN	CLOSE	2022-04-14/14:48:21	2022-04-14/15:40:10	WHEEL ALIGNMENT	51min 49sec
12	KL45L4334	WORKSHOP	TECHNICIAN	CLOSE	2022-04-14/15:43:15	2022-04-14/15:55:04	LUBRICATION	11min 49sec
13	KL45L4334	WORKSHOP	FI	CLOSE	2022-04-14/15:58:47	2022-04-14/16:15:14	FINAL INSPECTION	16min 27sec
14	KL45L4334	WORKSHOP	STAFF	CLOSE	2022-04-14/16:17:07	2022-04-14/16:31:32	ROAD TEST	14min 25sec
15	KL45L4334	WORKSHOP	STAFF	CLOSE	2022-04-14/16:34:19	2022-04-14/16:55:31	WASHING	21min 12sec

Total time spent in the workshop = 7hr 24min 14sec

Time taken to complete the service of the vehicle = 6hr 49min 20sec

Time lag between the work hours = 26min 23sec

time taken by the customer to receive vehicle = 35min 54 sec

Here the vehicle is renault kwid and this time mapping is carried out on its third service

from the gate in. Security first generate the QR with the vehicle number and this QR is scanned and this time is mapped ,then the customer reaches the customer relationship expert this time is also mapped.Then arrives the customer adviser and this time is also mapped. After this the job card is allotted and the vehicle entered for various jobs and this time during the work hours is mapped by the technician along its work flow. After the work done by the technician the vehicle goes to the final inspector then to the road test and the washing. The time along this procedures are mapped by the software and all the time taken by several jobs and department is mapped by this software. The idle time during the work hours is identified ,the time taken by the technician to do a specific job is identified ,and the the technician efficiency can also be measured.the time taken by the customer to receive vehicle after the service is also mapped

## TIME MAPPED DURING THE SERVICE OF KL47G3203 USING APPLICATION

Manager Home Staff Job Profile Logout

### Job Details

Sl.No	Reg No	Department	Staff	Status	In Date/Time	Out Date/Time	Remarks	Total Time
1	KL47G3203	WORKSHOP	SECURITY	CLOSE	2022-05-07/09:15:16	2022-05-07/18:10:29	IN AND OUT TIME	8hr 55min 13sec
2	KL47G3203	WORKSHOP	CRE	CLOSE	2022-05-07/09:41:13	2022-05-07/09:49:45	CUSTOMER ADVISORY IS ALLOTTED	8min 32sec
3	KL47G3203	WORKSHOP	CA	CLOSE	2022-05-07/09:57:11	2022-05-07/10:15:33	WORK ALLOTTED TO FC	18min 22sec
4	KL47G3203	WORKSHOP	TECHNICIAN	CLOSE	2022-05-07/10:23:11	2022-05-07/11:01:20	INSPECTION	38min 09sec
5	KL47G3203	WORKSHOP	TECHNICIAN	CLOSE	2022-05-07/11:02:26	2022-05-07/11:36:55	ENGINE OIL AND ENGINE OIL FILTER REPLACEMENT	34min 29sec
6	KL47G3203	WORKSHOP	TECHNICIAN	CLOSE	2022-05-07/11:38:52	2022-05-07/12:52:15	OP & SP GASKET REPLACEMENT	1hr 13min 22sec
7	KL47G3203	WORKSHOP	TECHNICIAN	CLOSE	2022-05-07/13:05:18	2022-05-07/13:49:35	SPARK PLUG CLEANING	44min 21sec
8	KL47G3203	WORKSHOP	TECHNICIAN	CLOSE	2022-05-07/13:52:41	2022-05-07/14:15:02	COOLING SYSTEM INSPECTION	22min 21sec
9	KL47G3203	WORKSHOP	TECHNICIAN	CLOSE	2022-05-07/14:16:23	2022-05-07/14:31:36	FUEL SYSTEM INSPECTION	15min 13sec
10	KL47G3203	WORKSHOP	TECHNICIAN	CLOSE	2022-05-07/14:32:36	2022-05-07/14:49:07	FUEL SYSTEM CLEANING	16min 31sec
11	KL47G3203	WORKSHOP	TECHNICIAN	CLOSE	2022-05-07/14:59:58	2022-05-07/15:56:10	WHEEL ALIGNMENT	56min 12sec
12	KL47G3203	WORKSHOP	TECHNICIAN	CLOSE	2022-05-07/16:05:11	2022-05-07/16:16:33	LUBRICATION	11min 22sec
13	KL47G3203	WORKSHOP	FI	CLOSE	2022-05-07/16:22:11	2022-05-07/16:38:09	FINAL INSPECTION	15min 59sec
14	KL47G3203	WORKSHOP	STAFF	CLOSE	2022-05-07/16:42:13	2022-05-07/16:59:24	ROAD TEST	17min 11sec
15	KL47G3203	WORKSHOP	STAFF	CLOSE	2022-05-07/17:02:11	2022-05-07/17:35:20	WASHING	23min 09sec

Total time spent in the workshop = 8hr 55min 13sec

Time taken to complete the service of the vehicle = 8hr 20min 4sec

Time lag between the work hours = 2hr 16min 58sec

Time taken by the customer to receive vehicle = 35min9 sec



## TIME MAPPED DURING THE SERVICE OF KL27F8232 USING APPLICATION

Manager Home Staff Job Profile Logout

### Job Details

Sl.No	Reg No	Department	Staff	Status	In Date/Time	Out Date/Time	Remarks	Total Time
1	KL27F8232	WORKSHOP	SECURITY	CLOSE	2022-04-28/8:45:12	2022-04-28/17:10:42	IN AND OUT TIME	8hr 25min 30sec
2	KL27F8232	WORKSHOP	CRE	CLOSE	2022-04-28/9:08:11	2022-04-28/9:17:33	CUSTOMER ADVISORY IS ALLOTTED	9min 22sec
3	KL27F8232	WORKSHOP	CA	CLOSE	2022-04-28/9:20:11	2022-04-28/9:38:3	WORK ALLOTTED TO FC	17min 42sec
4	KL27F8232	WORKSHOP	TECHNICIAN	CLOSE	2022-04-28/9:43:12	2022-04-28/10:16:25	INSPECTION	33min 13sec
5	KL27F8232	WORKSHOP	TECHNICIAN	CLOSE	2022-04-28/10:18:19	2022-04-28/10:50:54	ENGINE OIL AND ENGINE OIL FILTER REPLACEMENT	32min 35sec
6	KL27F8232	WORKSHOP	TECHNICIAN	CLOSE	2022-04-28/10:53:59	2022-04-28/12:04:12	OP & SP GASKET REPLACEMENT	1hr 10min 13sec
7	KL27F8232	WORKSHOP	TECHNICIAN	CLOSE	2022-04-28/12:06:17	2022-04-28/12:48:50	SPARK PLUG CLEANING	42min 33sec
8	KL27F8232	WORKSHOP	TECHNICIAN	CLOSE	2022-04-28/12:50:51	2022-04-28/13:14:19	COOLING SYSTEM INSPECTION	23min 28sec
9	KL27F8232	WORKSHOP	TECHNICIAN	CLOSE	2022-04-28/13:16:27	2022-04-28/13:30:53	FUEL SYSTEM INSPECTION	14min 26sec
10	KL27F8232	WORKSHOP	TECHNICIAN	CLOSE	2022-04-28/13:32:01	2022-04-28/13:56:33	FUEL SYSTEM CLEANING	24min 32sec
11	KL27F8232	WORKSHOP	TECHNICIAN	CLOSE	2022-04-28/14:12:11	2022-04-28/14:58:33	WHEEL ALIGNMENT	46min 22sec
12	KL27F8232	WORKSHOP	TECHNICIAN	CLOSE	2022-04-28/15:01:34	2022-04-28/15:14:55	LUBRICATION	13min 21sec
13	KL27F8232	WORKSHOP	FI	CLOSE	2022-04-28/15:17:58	2022-04-28/15:36:19	FINAL INSPECTION	18min 21sec
14	KL27F8232	WORKSHOP	STAFF	CLOSE	2022-04-28/15:41:23	2022-04-28/15:58:33	ROAD TEST	17min 26sec
15	KL27F8232	WORKSHOP	STAFF	CLOSE	2022-04-28/16:09:14	2022-04-28/16:32:35	WASHING	23min 21sec

Total time spent in the workshop = 8hr 25min 30sec

Time taken to complete the service of the vehicle = 7hr 47min 23sec

Time lag between the work hours = 1hr 19min 52sec

Time taken by the customer to receive vehicle = 38min 7 sec

## TIME MAPPED DURING THE SERVICE OF KL07CX3945 USING APPLICATION

Manager Home Staff Job Profile Logout

### Job Details

Sl.No	Reg No	Department	Staff	Status	In Date/Time	Out Date/Time	Remarks	Total Time
1	KL07CX3945	WORKSHOP	SECURITY	CLOSE	2022-05-18/10:05:11	2022-05-18/18:30:36	IN AND OUT TIME	8hr 25min 25sec
2	KL07CX3945	WORKSHOP	CRE	CLOSE	2022-05-18/10:21:31	2022-05-18/10:29:58	CUSTOMER ADVISORY IS ALLOTTED	8min 27sec
3	KL07CX3945	WORKSHOP	CA	CLOSE	2022-05-18/10:34:42	2022-05-18/10:52:41	WORK ALLOTTED TO FC	17min 59sec
4	KL07CX3945	WORKSHOP	TECHNICIAN	CLOSE	2022-05-18/11:00:03	2022-05-18/11:34:11	INSPECTION	34min 08sec
5	KL07CX3945	WORKSHOP	TECHNICIAN	CLOSE	2022-05-18/11:37:26	2022-05-18/12:14:12	ENGINE OIL AND ENGINE OIL FILTER REPLACEMENT	32min 46sec
6	KL07CX3945	WORKSHOP	TECHNICIAN	CLOSE	2022-05-18/12:17:16	2022-05-18/13:26:29	OP & SP GASKET REPLACEMENT	1hr 9min 13sec
7	KL07CX3945	WORKSHOP	TECHNICIAN	CLOSE	2022-05-18/13:29:14	2022-05-18/14:09:46	SPARK PLUG CLEANING	40min 32sec
8	KL07CX3945	WORKSHOP	TECHNICIAN	CLOSE	2022-05-18/14:11:28	2022-05-18/14:37:01	COOLING SYSTEM INSPECTION	25min 33sec
9	KL07CX3945	WORKSHOP	TECHNICIAN	CLOSE	2022-05-18/14:40:23	2022-05-18/14:54:14	FUEL SYSTEM INSPECTION	13min 51sec
10	KL07CX3945	WORKSHOP	TECHNICIAN	CLOSE	2022-05-18/14:58:21	2022-05-18/15:23:48	FUEL SYSTEM CLEANING	25min 26sec
11	KL07CX3945	WORKSHOP	TECHNICIAN	CLOSE	2022-05-18/14:39:49	2022-05-18/16:29:20	WHEEL ALIGNMENT	49min 31sec
12	KL07CX3945	WORKSHOP	TECHNICIAN	CLOSE	2022-05-18/16:44:22	2022-05-18/16:56:48	LUBRICATION	12min 27sec
13	KL07CX3945	WORKSHOP	FI	CLOSE	2022-05-18/16:59:41	2022-05-18/17:18:33	FINAL INSPECTION	18min 52sec
14	KL07CX3945	WORKSHOP	STAFF	CLOSE	2022-05-18/17:25:37	2022-05-18/17:42:23	ROAD TEST	16min 46sec
15	KL07CX3945	WORKSHOP	STAFF	CLOSE	2022-05-18/17:43:08	2022-05-18/18:17:30	WASHING	24min 22sec

Total time spent in the workshop = 8hr 25min 25sec

Time taken to complete the service of the vehicle = 8hr 12min 19sec

Time lag between the work hours = 1hr 46min 51sec

Time taken by the customer to receive vehicle = 18min 6sec

## 5.1 STANDARD TIME

In industrial engineering, the standard time is the time required by an average skilled operator, working at a normal pace, to perform a specified task using a prescribed method.[1]

It includes appropriate allowances to allow the person to recover from fatigue and, where

necessary, an additional allowance to cover contingent elements which may occur but have not been observed. Standard time =normal time +allowance Where; normal time =avg time \*rating factor.

The measured time with the application is compared with standard time from the workshop for several operations .The standard time for specific jobs are as follows

1	<b>WORK</b>	
2		<b>STANDARD TIME</b>
3	INSPECTION	45min
4	ENGINE OIL AND ENGINE OIL FILTER REPLACEMENT	45min
5	OP & SP GASKET REPLACEMENT	1hr 15min
6	SPARK PLUG CLEANING	55min
7	COOLING SYSTEM INSPECTION	30min
8	FUEL SYSTEM INSPECTION	20min
9	FUEL SYSTEM CLEANING	25min
10	WHEEL ALLIGNMENT	1hr 10min
11	LUBRICATION	15min
12	ROAD TEST	30min
13	WASHING	30min

# Chapter 6

## RESULT

### COMPARISON OF STANDARD TIME WITH ACTUAL WORK TIME

WORK	TIME (ALL IN MINUTES)				
	STANDARD TIME	KL27F8232	KL45L4334	KL07CX394	KL47G3204
INSPECTION (1)	45.00	33.13	36.11	34.08	38.09
ENGINE OIL AND ENGINE OIL FILTER REPLACEMENT (2)	45.00	32.35	34.58	32.46	34.29
OP & SP GASKET REPLACEMENT (3)	90.00	70.13	67.36	69.13	73.22
SPARK PLUG CLEANING (4)	55.00	42.33	44.41	40.32	44.21
COOLING SYSTEM INSPECTION (5)	30.00	23.28	26.23	25.33	22.21
FUEL SYSTEM INSPECTION (6)	20.00	14.26	15.59	13.51	15.13
FUEL SYSTEM CLEANING (7)	25.00	24.32	23.39	25.26	16.31
WHEEL ALIGNMENT (8)	70.00	46.22	51.49	49.31	56.12
LUBRICATION (9)	15.00	13.21	11.49	12.27	11.22
ROAD TEST (10)	30.00	17.26	16.27	16.46	17.11
WASHING (11)	30.00	23.21	14.25	24.22	23.09

The standard time is compared with the actual work time taken for the servicing of the vehicle and it was observed that the time taken to complete the work is found to be lesser than the standard time. For work measurement, we visited the workshop several days and conducted work measurement on different cars of same model (Renault kwid) with similar service procedures (third service) .Conducting the work measurement with the software helped to track the work flow of the vehicle more easily. The software helps to monitor the total work hours , time lag during the service and time taken for each process can all be identified. With this software the worker efficiency can also be measured that is the time

taken by the worker to complete a particular job is mapped with this software application. It is found that the worker taking more time can be identified and the management can take necessary actions to improve the work efficiency.

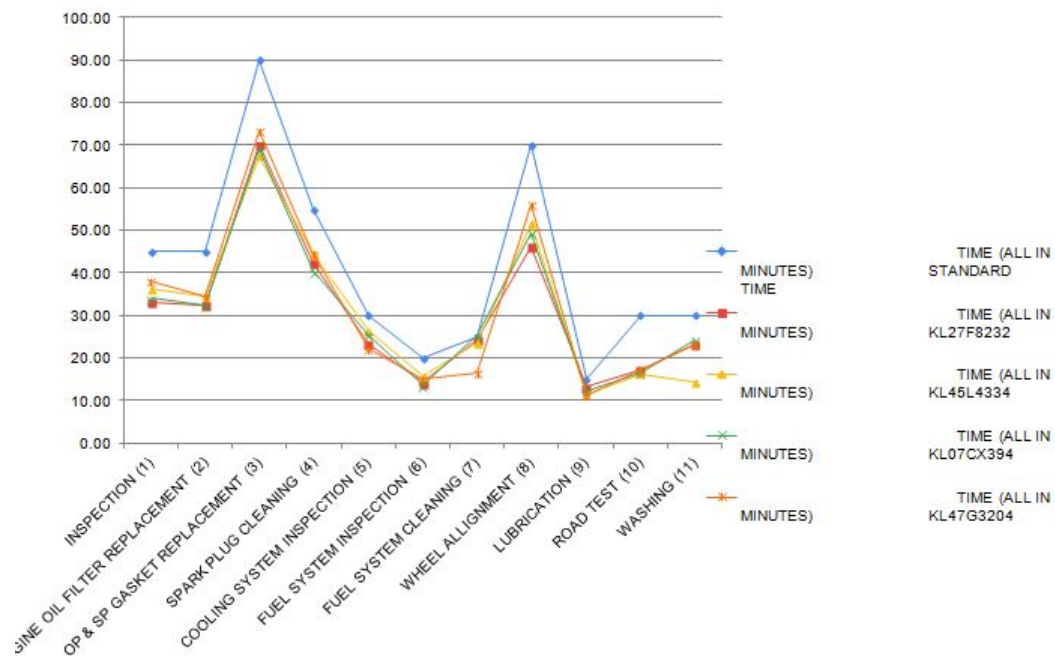


Figure 6.1: work-time graph comparing std time and actual time taken by the selected vehicles

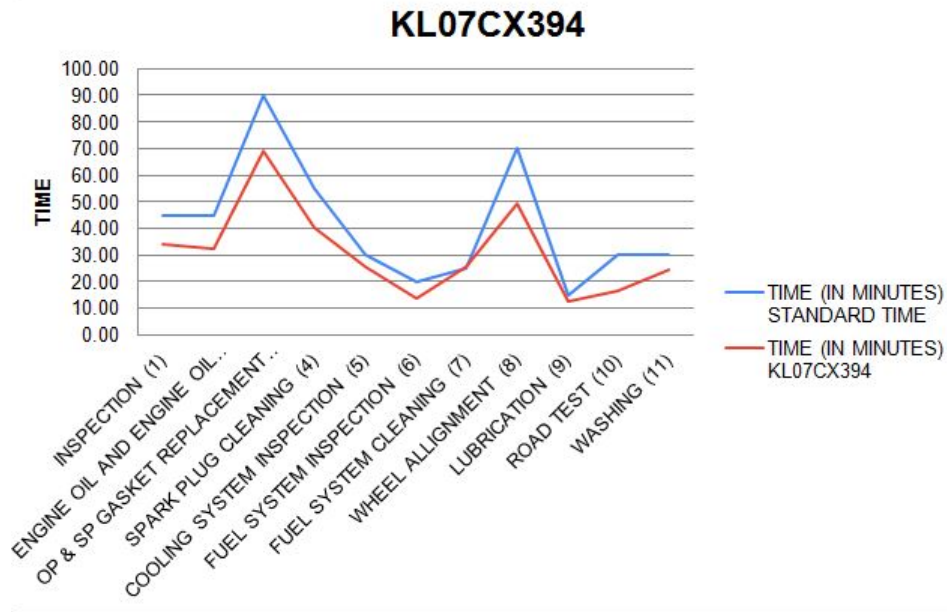


Figure 6.2: work-time graph comparing std time and actual time taken by the specific vehicle KL07CX394

On comparing the time taken for selected jobs compared with standard time it is observed that after the usage of software application in the workflow it helps to finish the job not exceeding the standard time

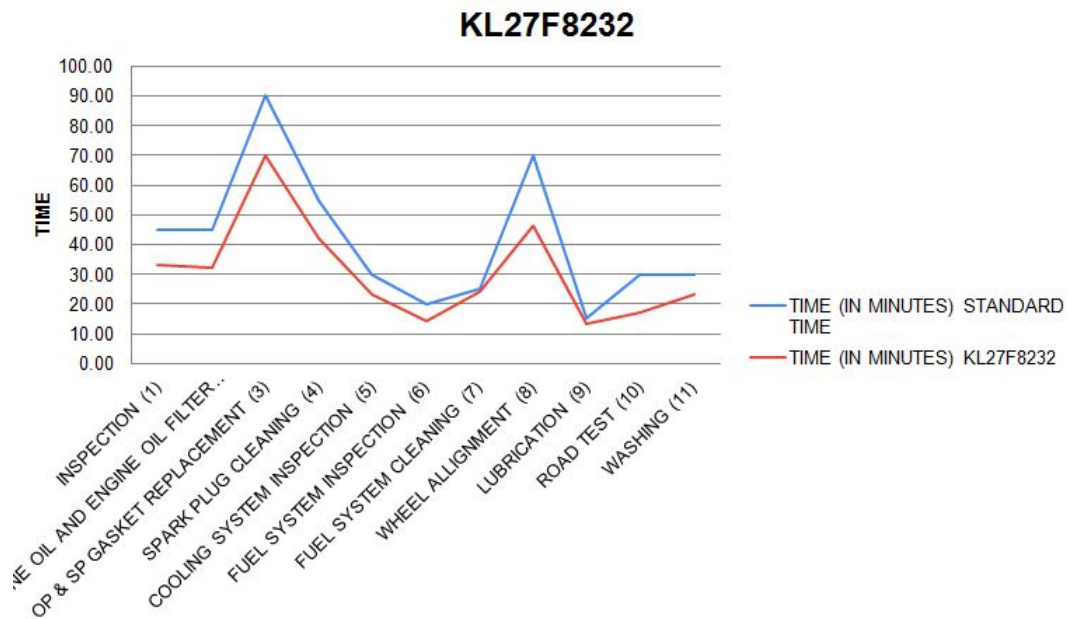


Figure 6.3: work-time graph comparing std time and actual time taken by the specific vehicle KL27F8232

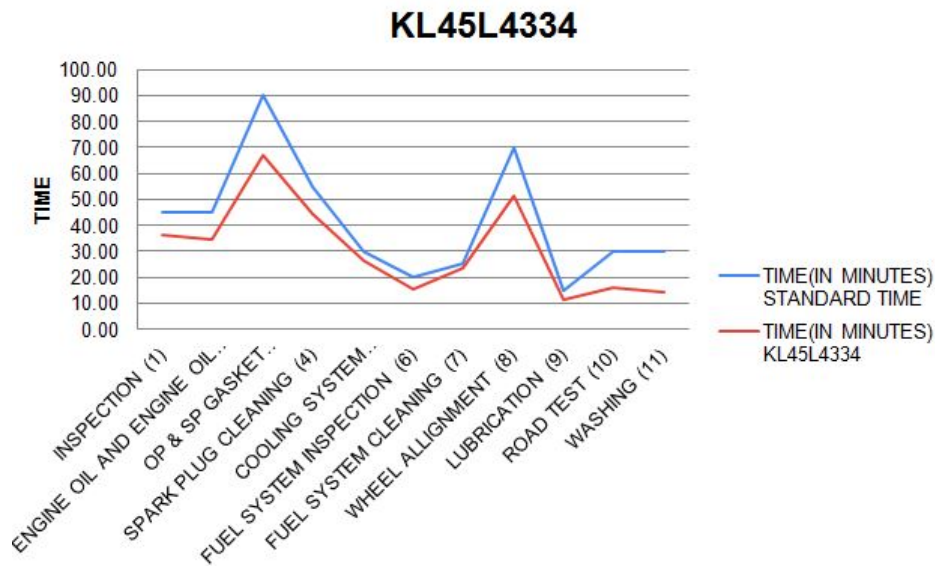


Figure 6.4: work-time graph comparing std time and actual time taken by the specific vehicle KL45L4334

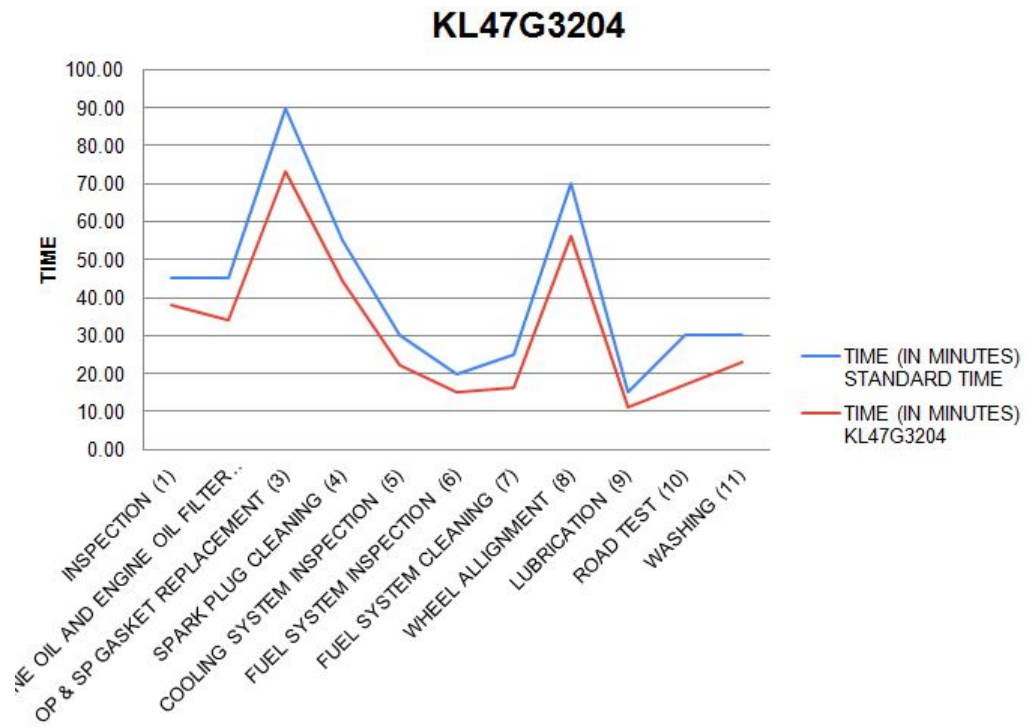


Figure 6.5: work-time graph comparing std time and actual time taken by the specific vehicle KL47G3204

The time taken for each job on this four cases of work measurement shows that after the usage of this software application the actual work time does not exceed the standard time



# Chapter 7

## CONCLUSION

Servicing of vehicles take more time due several reason before the implementation of application. In order to detect and quantify the idle time in the workshop, a time study has been carried out using a software programme and it has been noted that, following the installation of the app, less time is needed to perform each operation, as well as a decrease in the overall amount of time needed for service. First of all, the decrease in time is attributable to the fact that the employees are aware that they are being watched by management following the introduction of software. Second, it was noted that the workshop acquired a well-organized structure once the software application was put into use. After the implementation of application, the servicing of vehicles became more efficient and faster leading to customer satisfaction.

The automobile business has a lot of room for development, including ways to raise worker productivity. It can be challenging to be productive at work, particularly if there is no method to keep track of your progress. Most workers produce some idle time while at work. To monitor the actions of employees cameras can be mounted on the workspace. It won't offer monitoring tailored to a particular job. Although cameras create a psychological barrier of being watched however watching over every employee with cameras will take a lot of time and effort. Even if the service centres have the capacity to complete the work more quickly, idle time causes the work to be delayed. This problem can be solved with the

help of time mapping application. This app will reduce the effort and time required to monitor each and every employee in the workplace and also improve the work efficiency.

# Chapter 8

## FUTURE ASPECTS

Future improvements to this project include the use of an AI camera to automatically generate a QR code as soon as a vehicle approaches the gate. The AI camera will scan the vehicle identification number and produce a QR code that must be adhered to the vehicle. Currently, the security at the front gate handles this, but installing AI cameras will assist to automate and reduce labour in the future.

Another improvement we can make to this project is to let the customers know when their specific cars arrive at each department. For instance, if a car is in a paint spraying station, the app will show that the car has arrived there and will notify the customer when it enters the next station. This will increase customer satisfaction and strengthen the relationship between the business and its clients. They'll have faith in the service centre.

Another improvement we can make to this project is that once an operation has been completed in the service centre, it notifies customers via the app when the subsequent, identical operation must be completed. For instance, if an oil change has been completed on a specific car and is finished then the subsequent oil change must be performed in roughly six months. This will be notified to the customer by the workshop or the service centre via the app at the time when the oil change is required. It will be easier for the company to access the database of the vehicles more easily. The company will be able to access the vehicle database with less difficulty.

# Chapter 9

## BIBLIOGRAGHY

- 1.M. S. Hossain, A. Zahid, R. J. Hoque” Improvement of Service Quality at Automobile Workshop in Bangladesh”, ICBM 2017 - 1st International Conference on Business Management, Dhaka September 2017
- 2.Mayank Agrawal, Prof. Ranjit Singh, Rishabh Singhal, 2017, Productivity Improvement and Capacity Enhancement of an Automobile Industry: A Case Study, International Journal of Engineering Research Technology (IJERT) Volume 06, Issue 11 (November 2017), <http://dx.doi.org/10.17577/IJERTV6IS110230>
- 3.Mohammad Javed, Dr.Parul Gupta , Dr.Vishal Saxena ”.Role of Service Quality and Customer Satisfaction in Four Wheeler Automobile Service Industry”: A Review, 2015
- 4.Ashish Kalra ,Sachin Marwah,Sandeep Srivastava ,Rajesh Bhatia ”Productivity Improvement in Assembly Line of Automobile Industry by Reducing Cycle time of Operations” ,2016
- 5.Ashish Jain, Dr. Devendra S. Verma”Improvement On Service Quality Of Automobile Service Center ,2019
- 6.Mohammad Javed, Dr.Parul Gupta , Dr.Vishal Saxena ”.Role of Service Quality and Customer Satisfaction in Four Wheeler Automobile Service Industry”: A Review, 2015
- 7.Ashish Kalra ,Sachin Marwah,Sandeep Srivastava ,Rajesh Bhatia ”Productivity Improvement in Assembly Line of Automobile Industry by Reducing Cycle time of Operations”

,2016

8.Ashish Jain, Dr. Devendra S. Verma”Improvement On Service Quality Of Automobile Service Center” ,2019