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Smart Vehicle Service Management System Using IoT

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Abstract: To ensure the proper operation and efficient operation of the vehicle, regular vehicle service is necessary to monitor various parts of the vehicle. This paper “Smart Vehicle Service Management System using IoT” is being proposed to detect some problems in vehicle and also it provides a platform to book online service to the vehicles. It sends an alert message in form of SMS to the user if any problem is detected and suggests that servicing to vehicle is now required. The system is integrated with different sensors like FSR, adxl, DHT11, level etc to detect problem in vehicle and being displayed in LCD, so if any problem is detected the buzzer will give alert sound indicating the vehicle has a problem. Along this a Node MCU and GSM module is being placed to get live updates in cloud and also in a form of SMS and the same data is stored data in cloud. The alert message received in form of SMS is redirected to the SVSMS website which will allow the user to book online service. The proposed system helps the user to detect the problems in prior and act precisely so that efficiency of the vehicle is maintained and cost/inconvenience could be avoided.

Keywords: Internet of Things, Arduino UNO, Node MCU, GSM Module, Arduino IDE, Adafruit IO, Vehicle problem detection and service management, ADXL Tilt, FSR, Limit Switch.

I. INTRODUCTION

Vehicles have become an integral component of daily life. The majority of people rely on automobiles for daily transportation. In this densely populated mechanical world, everyone relies heavily on vehicles and the road transit network to get around. From the dawn of civilization, transportation has been an integral aspect of human development. As the population expands, so does the number of automobiles on the road. According to Ward's estimates, there are approximately 1.4 billion vehicles on the road today, excluding off-road and heavy construction vehicles. According to the WHO's 2008 World Health Statistics, road traffic injuries will be the fifth largest cause of mortality. According to the WHO's 2015 global status report on road safety, over 1.25 million people die every year as a result of road accidents. The majority of accidents are caused incidents caused by vehicle faults just because vehicle maintenance is frequently neglected, most times owing to a hectic schedule, a person fails to get his vehicle repaired, resulting in an increase in difficulties. Regular vehicle maintenance is necessary to ensure that various components of the vehicle operate properly and effectively. The vehicle's condition is periodically checked by the vehicle service management and monitoring system. This guarantees that your vehicle runs smoothly, that fuel is used effectively, that it runs efficiently and lasts as long as possible, and it also gives you the assurance that you have taken every precaution to ensure the safety and efficiency of your vehicle. Inadequate security and protection, excessive and unnecessary wear and tear, vehicle damage, poor fuel economy, inconvenience, and so forth are some risks of not having regular vehicle maintenance. Why should a vehicle be serviced regularly? Regular maintenance ensures that your vehicle is reliable and efficient. It is likely the single most important factor in ensuring the vehicle's longevity. When a vehicle is serviced on a regular basis, the many parts, components, and systems are examined. This means that problems are detected early on, and repairs can be made before significant stress is applied to vehicle components, resulting in inconvenient and potentially costly breakdowns. Regular maintenance improves the safety and performance of your vehicle while also improving fuel efficiency and lowering carbon emissions.

II. RELATED WORK

We have gone through multiple papers in which people have proposed different models which are either concerned with accident and safety or only applications to book online service to vehicles, so we have come up with a paper in which we have proposed system “SVSMS” which will not only detect a problem in but also provides an efficient web application to book online service to the vehicles. So below are some papers which conveys about different technologies that are implemented in order to maintain human and vehicle safety. [1] So they proposed a system that would auto manage complete servicing process and along that they were also able to keep watch on changes and functioning done to the vehicle.

The proposed system checks the state of vehicle periodically and if any problem is detected it sends alert message to owner conveying the issue and suggesting for the service. [2] Next is they proposed an application that recognizes the state of accident using different sensors and sending the details to nearby emergency service providers like hospital and police station using an android application. So based on tilt angle of the vehicle they detected accident and GPS to track the location. [3] Here the same thing again they proposed an IoT based model to recognize accidents. So here when an accident is encountered it sends message to emergency service providers via WhatsApp along that longitude and latitude values are shared to get exact spot location. [4] The proposed model comprises of same modules as above 2 and 3 papers. But apart from this what they did was using an machine learning concepts they calculated the eye closure and drowsy state of driver, based on the set parameters the warning was send in form of alarm. [5] The proposed system was implemented in order to detect accident and to prevent thefts. Here again the same thing they were able to detect the accident and based on the severity of vehicle alert was sent to the particular authorities, using IoT technology they were able to keep watch on vehicle constantly and control remotely. [6] They proposed a system to avoid car collisions and decreasing the rate of increasing accidents. In this system they were able to detect the amount of alcohol the driver has drank using machine learning algorithm and using IoT sensors it would predict danger and refuse to start unless the person with no alcohol consumed sits on driving seat. [7] They have come up with web application to provide online service to the vehicles by providing efficient interface to clients. So in the proposed system they are providing online service to vehicle where the user can check for nearby service station and book the online service from the current location. [8] In this paper they have implemented a smart system to maintain the security of vehicles by monitoring and controlling using different sensors and also to have access from remote area. [9] In this paper, they have proposed a model to provide home security. Whenever there is a motion in front of the camera, it gives a security alert in terms of a beep sound, and an SMS/ mail is delivered to the owner. [10] This paper discusses again the same things in which their proposed model will detect accident and intimate the same to all necessary people along with the spot of accident. [11] In this paper they proposed a technique to detect drowsiness based on eye closure of driver using machine learning algorithm and give an alert message to driver based on set parameters. [12] In this paper they discussed on implementation of accident detection using Smartphone, ad-hoc network and machine learning concepts. [13] They proposed a model to reduce cost of distribution and cargo damage by providing efficient route to vehicle using cold chain system. [14] They proposed a model to detect accidents using in-built sensors of the Smartphone, and provide the accident information to all service providers based on the received results by classifying the type of accident. [15] They have proposed an IoT system to detect accident of motorcycle using adxl tilt sensor which will give results based x, y, z axis of vehicle. For this project they made experiments' on different motorcycles by calculating the maximum inclination capacity of vehicle and if crosses the set limit it would detect accident and sent alert message to close people. [16] Using IoT technology they proposed a model to manage traffic and provide a green corridor to ambulance with patient. The tag is placed on ambulance which sends signals to all traffic police on the way to hospital from current location. So once the ambulance passes through a signal RFID reader scan the tag on it and send update to next traffic officer so that green corridor is provided.

III.METHODOLOGY

There are two aspects to the smart vehicle service management system. One is a web interface that allows users to book vehicle servicing online, and the other is an IoT device that is embedded into the vehicle to identify faults. Web applications eliminate the need for additional manual record-keeping and report-generating hours. All users of this application have simultaneous access to a central repository. Managing historical data in a database is very simple.

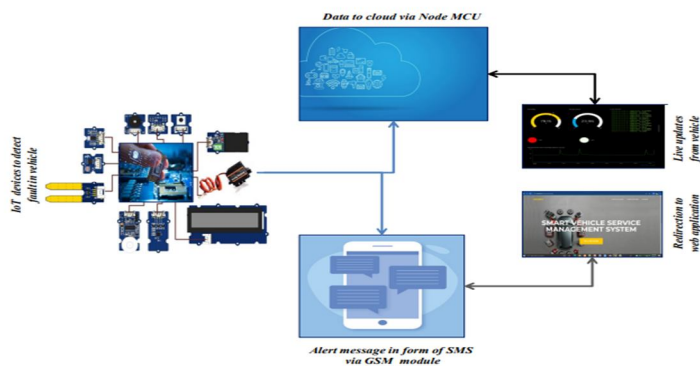


Fig 1: Overview of SVSMS

The web interface contains two modules, Admin module and User module. Admin module, it operates on mainly three concepts: User registration, service charges and submission module which consists of user login creation, user login details, user request details, response from user and bill details. User module consists of login page, send request, service form, problems/issues and service update. Verification is done from both admin and user. User Registration: In this module the username, password, phone number and email address of the user is registered and login credentials are provided to the user. In service charge section the Customer Name, Vehicle number, Parts and Servicing Charges as well as payment mode are registered. In the submission section the vehicle will be handed over to the Customer and before handover the Customer name, Vehicle number, Warranties of vehicle parts and service records are recorded.

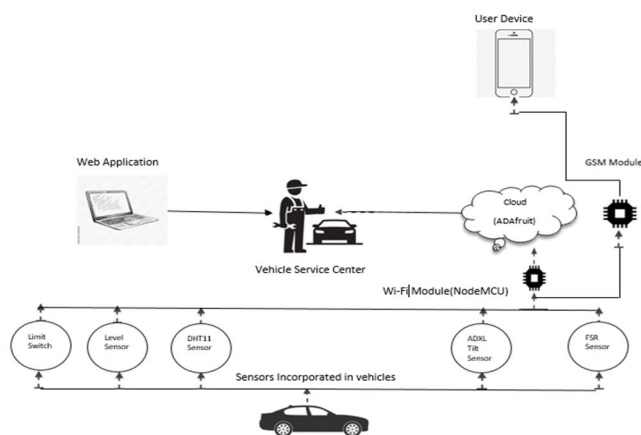


Fig 2: Block diagram of SVSMS System

The sensors are connected through microcontroller with help of I/O pins. Depending on the sensors values the microcontroller takes decision whether it is detected or not detected. The collected data is sent to web application ADAFRUIT IO with help of Wi-Fi module [Node MCU]. The data is monitored with help of web application. Depending on the respective values of sensor like adxl (tilt-sensing), FSR (Force Sensing Resistor) etc these controllers alerts the system, along this a GSM module is being connected to the microcontroller which sends the alert message to the user along a link in it in the form of SMS which is redirected to the web application where the user can book online service. This proposed model uses IoT sensors to monitor the vehicle continuously. The IoT devices placed in vehicles is designed using Atmega 2560 that is connected with different sensors to detect fault immediately in an vehicle. The code to activate/run sensors as per our requirement is written in embedded C in Aurdino IDE software and is being dumped into the microcontroller. When any sensor senses the failure, the SVSMS detects it immediately send the data to IOT as well as display in LCD board. The detected problems are stored in Adafruit IO. You can gather, visualise, and analyse real-time data streams in the cloud using the Adafruit IO. From your devices, you can send data to Adafruit Io, visualise live data instantly, and alert the user device.

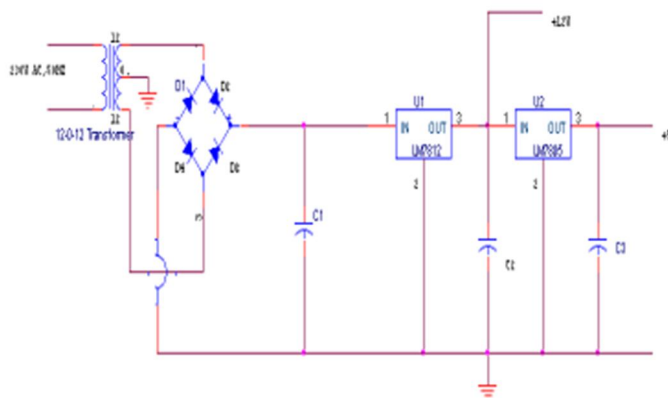


Fig 3: Power Supply Unit

Different voltages are required for the various circuits in the proposed model. Therefore, different voltage transformers, rectifier circuits, filter circuits, and regulator circuits must be used to build various power supplies of various voltages. Numerous components are needed for this style of construction. As a result, the power supply grows large and expensive. We use voltage regulator ICs (12V, 9V, etc.) that can be obtained with just one transformer to get around the aforementioned drawbacks. The figure displays the dual power supply circuit diagram.

IV. IMPLEMENTATION AND RESULTS

In this model different devices are placed on a board to detect some problems in vehicle and the live updates of vehicle are viewed and stored in Adafruit IO, so once the problem is detected, the user will receive the user will receive a alarm indicating a problem and along that a SMS is sent to user, where the user can book an service to their vehicle. Different IoT devices like Aurdino UNO, Node MCU, GSM module, LCD display board, DHT11, limit switch, adxl, FSR, smoke and fire, level, led light, buzzer sensors and power supply unit are used in this model to detect a issue in vehicle.

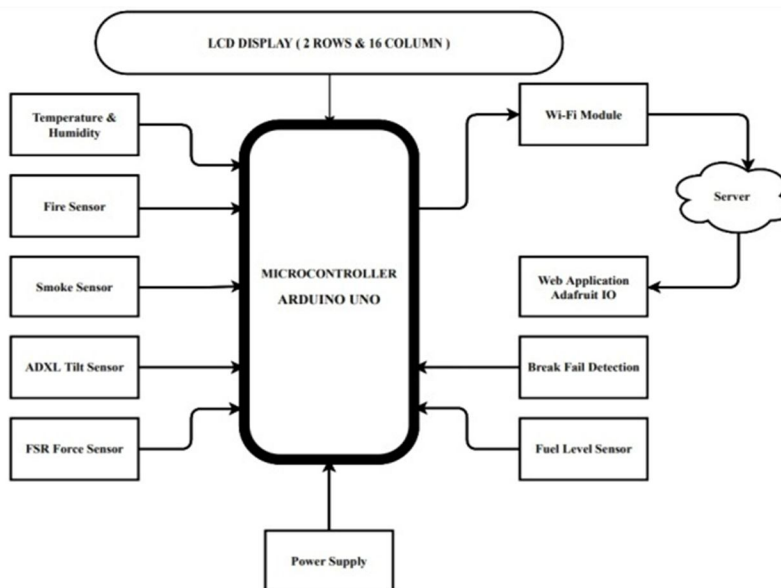


Fig 4: Block diagram for problem detection

Atmega 2560 is 8 bit microcontroller that is based on RISC architecture with 16MHz CPU speed and 256kb flash memory that is used to execute instructions in a single go. The microcontroller is also called as Aurdino UNO, which is used to connect the sensors to different pins so that it executes the given instructions in single clock cycle. Node MCU [ESP8266] module is a microcontroller used to connect objects and let data transfer using Wi-Fi protocol. In this module we are using Node MCU to load and store data into open source platform to receive live updates. Here ESP stands for extrasensory perception. GSM module to connect internet and to send and receive SMS using GSM library. Here gsm module is used to send the alert message regarding the issue detected via SMS where user can book the online service to vehicle. GSM is Short Messaging Service module built for wireless monitoring. This module can receive serial data from devices and send it to a host server as text SMS. LCD to display the live vehicle updates from different sensors. DHT11 to measure humidity and temperature of the vehicle. Adxl335 is a accelerometer module used for tilt sensing, based on vehicles x, y, z axis. FSR is a force sensitive sensor that is used detect, if any heavy force acted on vehicle. Level Sensor is used to measure the oil level and petrol level of the vehicle, if oil level found low it alerts the user to get his vehicle serviced. Limit Switch is used to detect break failure. Smoke and fire sensors are used to detect smoke or any upcoming major problems related to fire in battery vehicles. Buzzer is used to give alarm or beep sound to user regarding the issue. Power supply unit is used to supply different voltages to the devices. Aurdino IDE is a software that is used to write and upload the code to Aurdino UNO. Adafruit IO is open source platform designed to display, respond and interact with cloud services to receive live updates from vehicle and same data to be saved permanently in cloud. As GSM module receives a signal indicating a problem it sends an alert sms to the user along link which is redirected to web application where the user can book online service.

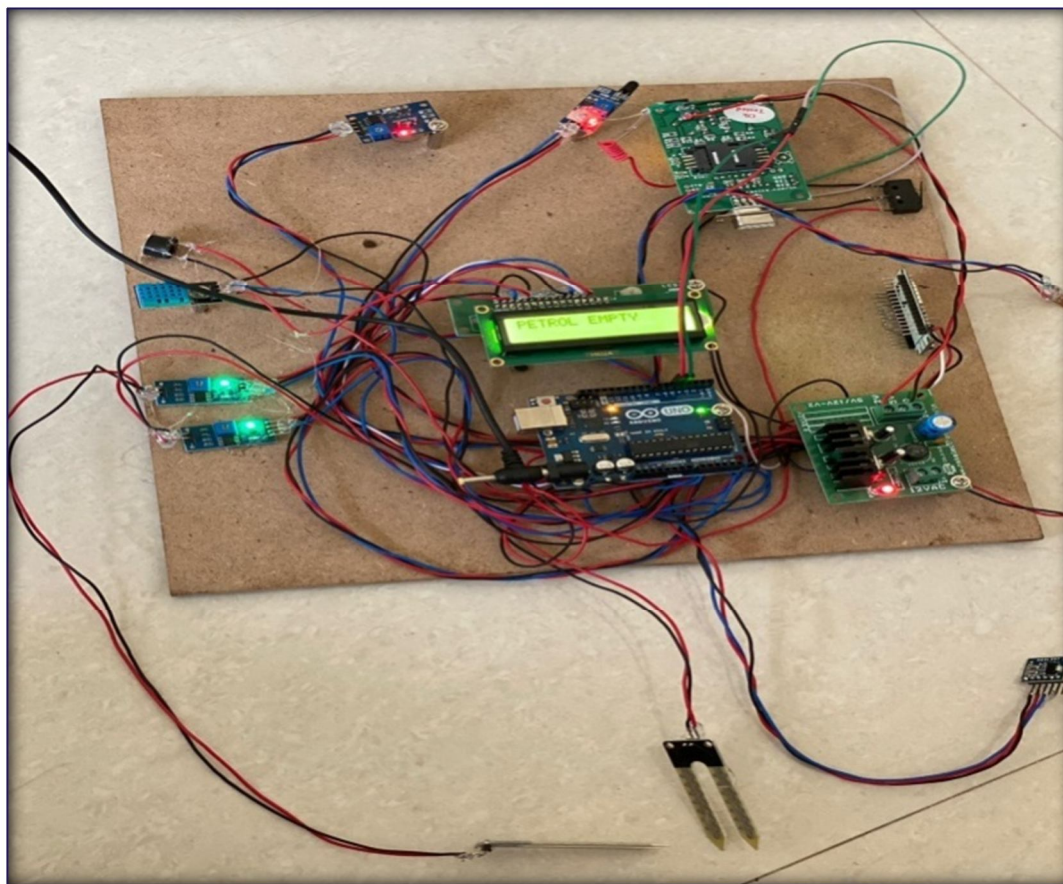


Fig 5: IoT based problem detecting model

This is the IoT based SVSMS model used to automatically detect problems in an vehicle and send alert message to vehicle owners or users in different forms.

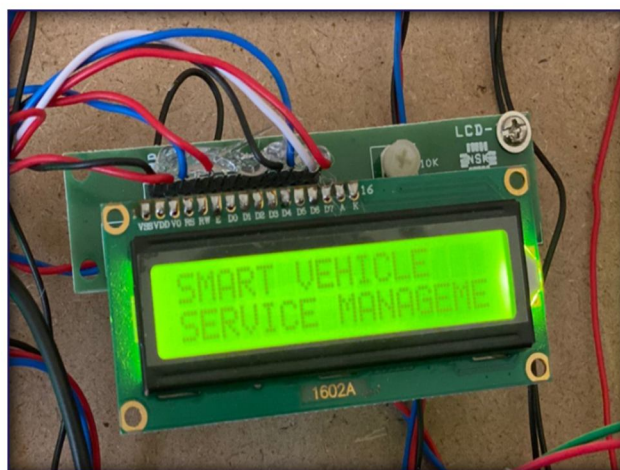


Fig 6: Live update in LCD

So once the problem is detected data is being continuously displayed using LCD based on set parameters. Apart from LCD we get live updates in Adafruit IO and same data is stored in cloud permanently. Once the Arduino detects a problem it sends data to the GSM module, and the GSM module sends an alert message to the user stating the vehicle needs to be serviced along with the statement we are providing the link to the web application where the user can book online service and get the vehicle serviced.

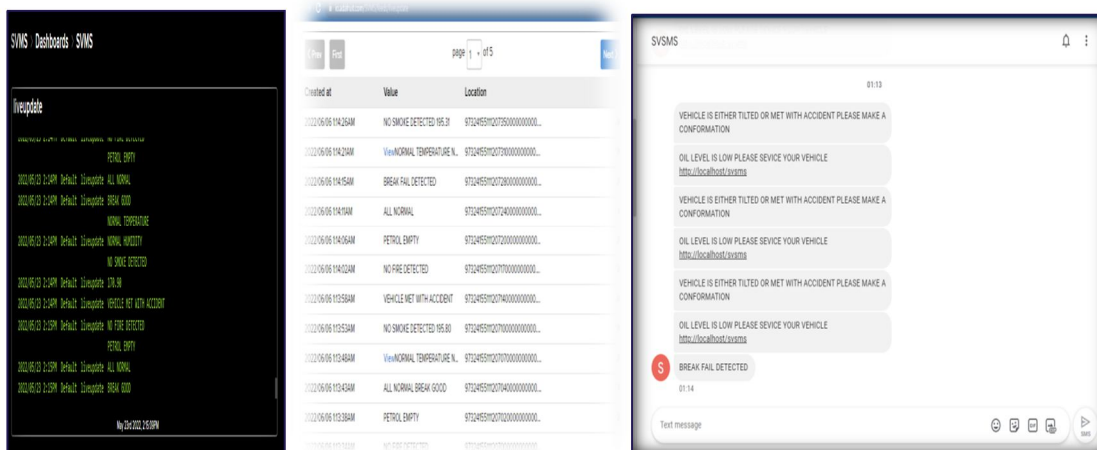


Fig 7: Live updates of vehicle in Adafruit IO and Alert message to user in form of SMS.

The smart vehicle service management system provides vehicles for service, and if a customer has a problem with his vehicle, he can book service online through our web application. The user model and the admin model are the two fundamental modules in a web application.

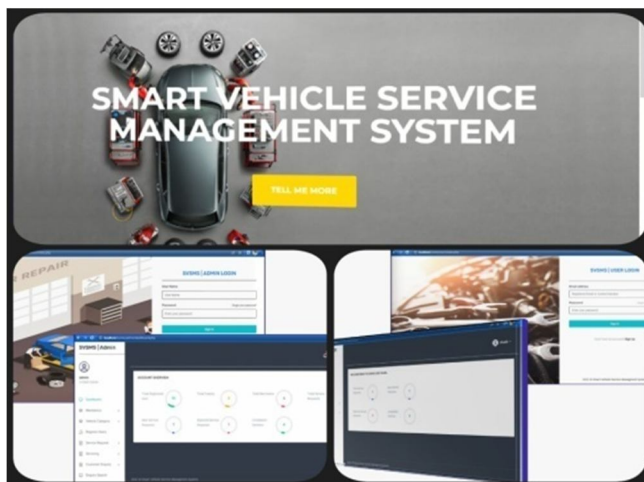


Fig 8: Web Application to book online service

V. CONCLUSIONS AND FUTURE SCOPE

The proposed system is built to provide ease to customers with additional features such as pre booking of slots, auto calculation of bill and time, and a module to describe steps that undergoes during the procedure of servicing of a vehicle. By the Smart Vehicle Service Management System, the user can detect the problems in a vehicle in prior and act precisely so as to avoid major issues in vehicle he can opt for online services and get vehicle serviced. This saves lots of time which was being simply wasted for no reason. So, if this system is implemented by the vehicle manufacturing companies it would be more profitable because this system will detect problems in vehicle, give notification if any problems and the main thing is service will provided door to door, which is very helpful for people having busy schedule. We all know there is no hold to miss regular service to maintain good efficiency and safe operations of vehicle, so it necessary to provide on time service to vehicle.

And coming to future scope if the proposed system is being implemented by an vehicle manufacturing company it would expand the growth the industry because the proposed system is used to detect a problem in vehicle and also it provides an efficient web application where the user can book online service to their vehicle. We all are aware of the individual's busy schedules due to which on time vehicle service is always neglected, if the proposed system is implemented it would provide job to drivers to pick and drop vehicles and along that efficiency of vehicle is well maintained for getting on time service.

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