Generalized Automatic Two-Wheeler Driving License Skill Test System

Prativa Pranav Saraswala
Assistant Professor, Electrical Engg. Dept.,
The Faculty of Technology and Engineering,
The M. S. University of Baroda, Vadodara

Farah M. Pathan
Assistant Professor, Electrical Engg. Dept.,
The Faculty of Technology and Engineering,
The M. S. University of Baroda, Vadodara

***Abstract*: The main objective of this project is to automate the existing skill test system for two-wheeler driving licenses. As more individuals acquire two-wheeler vehicles for their transportation needs, it becomes crucial to verify their driving skills for safety. In India, the Regional Transport Office (RTO) is tasked with evaluating driving safety, conducting driving license tests under the supervision of appropriate government officials. This initiative aims to automate the testing procedure by utilizing sensors and microcontrollers to improve safety and develop more proficient drivers.**

The system is affixed to the candidate's ankle, consistently tracking foot movements throughout the test, with data being wirelessly transmitted to a web server that is monitored and managed by government officials outside the testing environment. Upon completion of the test, the system will automatically evaluate the data to detect any errors and present the results, which will be shown on the web server. Our objective is to streamline the administration of this test for government officials while enhancing accessibility for the candidates participating in the assessment.
Keywords: microcontrollers, Regional Transport Office (RTO), skill test system

I. INTRODUCTION

Two-wheeler vehicles represent a highly efficient and swift mode of transportation that is widely embraced in India and numerous developing nations, where not everyone can afford cars. However, a significant disadvantage of two-wheeler vehicles is that operators must maintain both speed and balance while riding; if a driver lacks the necessary skills to operate the vehicle safely, it can pose risks not only to themselves but also to those around them. To mitigate this issue, it is mandatory for all individuals to wish to operate a two-wheeler to successfully pass a driving license examination. In India, two assessments are conducted to obtain a license. The first is a learner's license test, which evaluates the driver's understanding of traffic regulations through a computer-based format. Once a learner's license is acquired, the candidate may proceed to the actual driving examination, where they must demonstrate their driving abilities before government officials. These assessments are administered at the Regional Transport Office (RTO). According to the Road and Transport Minister, Shri Nitin Gadkari, approximately 30% of motorists possess fraudulent licenses. This project aims to automate the skill assessment required for obtaining a license and to ensure its compatibility with the current system. Let us examine the current testing procedures. In simple terms, candidates must navigate a testing track shaped like the English number 8. To pass the examination, they must complete the course within a specified time frame without placing their feet on the ground from the point of entry to exit. Additionally, the vehicle must not cause any damage to the track. Failure to meet any of these criteria will result in the candidate's disqualification. Our project seeks to evaluate these criteria to cultivate better drivers. It is important to clarify that we are not criticizing the existing system; rather, we are endeavouring to automate the process of assessing criteria that have already been sanctioned by the government.

To achieve the project's objectives, we are monitoring the vertical movement of the foot while the vehicle is on the track. Here to achieve the objective of the project we are tracking the vertical movement of foot while vehicle is on the track. Additionally, we are gathering movement data and processing it once the vehicle exits the track or after the designated period (in this case, 1 minute) has elapsed. To achieve this, we utilize NodeMCU for data processing, transmission to web servers, and conduct tests wirelessly. For the measurement of foot movement, we employ the MS5611 Barometric pressure sensor, which also measures altitude in relation to pressure. The control function, results, and all pertinent information regarding candidates are accessible on any web browser via the IP address.

II. RELATED WORK

Paper [1] discusses the automation of the driving license test system. Our objective is to transform a mechanical process into a computerized one. Currently, the existing system in India relies entirely on human involvement, starting from the application process, through verification, inspection, and ultimately issuing the license, all of which require human intervention. Typically, during the driving test, a candidate applying for a license must navigate a closed-loop path in front of the authorities. The candidate is required to drive along this path without any assistance from the ground surface, and failure to do so results in disqualification. Consequently, the authorities monitor the candidate manually. The proposed system aims to automate the bike driving test by substituting human oversight with our device, while also evaluating the entire process. This innovation will minimize manual intervention and yield impartial results. One of the key aspects of this initiative is to automate the inspection of the driving test. Proposed concept is intended to assess the driving capabilities of candidates through technology, thereby eliminating brokerage and financial losses.

In [2], a LabVIEW system equipped with sensors has been developed to observe the candidate seeking a license through LabVIEW. This system allows for the monitoring of candidates who fail to keep their foot within the vehicle, as indicated by differential output from the sensor. The data is then processed by a microcontroller and transmitted to LabVIEW via a laptop or PC. Additionally, the system authenticates the number of candidates entering the license test using a fingerprint sensor, enabling automatic selection or rejection by the system.

The objective of [3] is to establish a clear, efficient, and transparent testing process for any individual seeking a driving license. This will be achieved by monitoring the driving skills of candidates during the driving test on an automated track or using an automated vehicle. The proposed solution involves the customization of an AVR controller-based embedded system to assess the status of sensors (IR Proximity and Ultrasonic sensors) installed on the track or the vehicle, utilizing IoT technology to relay the results of the test (pass or fail) to senior RTO officials. This innovative solution serves as a societal contribution by addressing corruption and decreasing the number of road accidents, which are often caused by inadequate planning, anticipation, and control—factors that heavily rely on an individual's driving skills.

III. IMPLEMENTATION OF SOFTWARE AND HARDWARE SYSTEM

In this context, the term 'Software system' refers to the segment of code capable of wirelessly managing the entire system from a secure distance. As illustrated in **Fig 1**, there are several buttons designated for controlling the test, which will be operated by the relevant authority. Each button possesses two states, and based on its state, it will issue commands to the system. Prior to pressing any button, it is essential to confirm that a connection has been established between the NodeMCU and the web server, and that the sensor is successfully connected. This process will occur automatically upon powering on the system, and the status of all connections will be displayed on the serial monitor.

Fig 2 illustrates several buttons designed for test control, which will be managed by the relevant authority. Each button features two states, and the system will respond according to the selected state. Prior to pressing any button, it is essential to confirm that a connection has been established between the NodeMCU and the web server, and that the sensor is successfully connected. This process will occur automatically upon powering on the system, with the status of all connections displayed on the serial monitor.

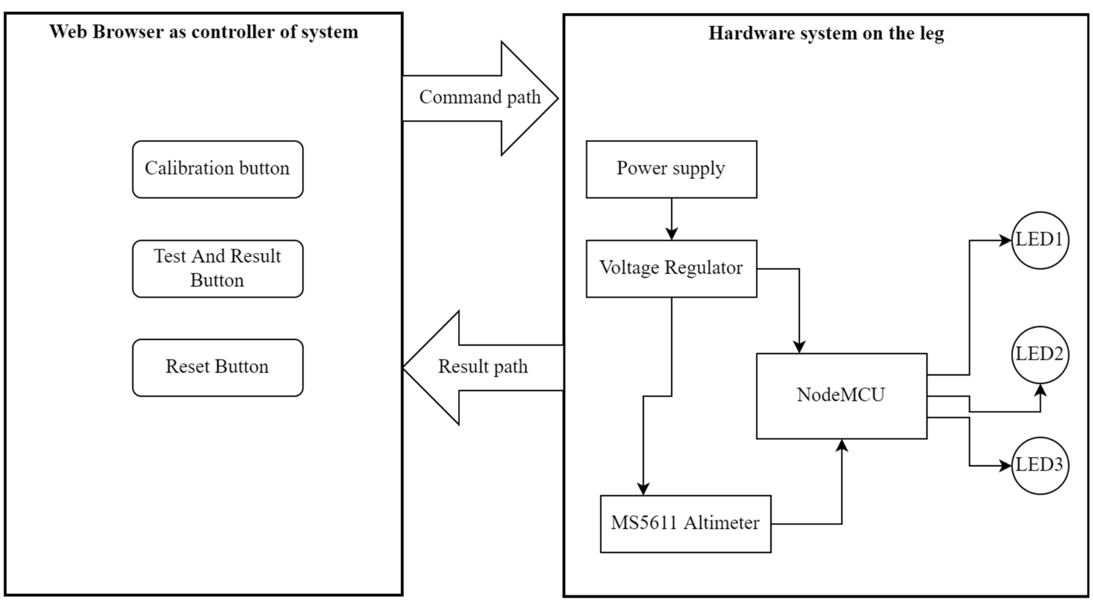

Fig 1. Block diagram of Automatic Driving license skill test system

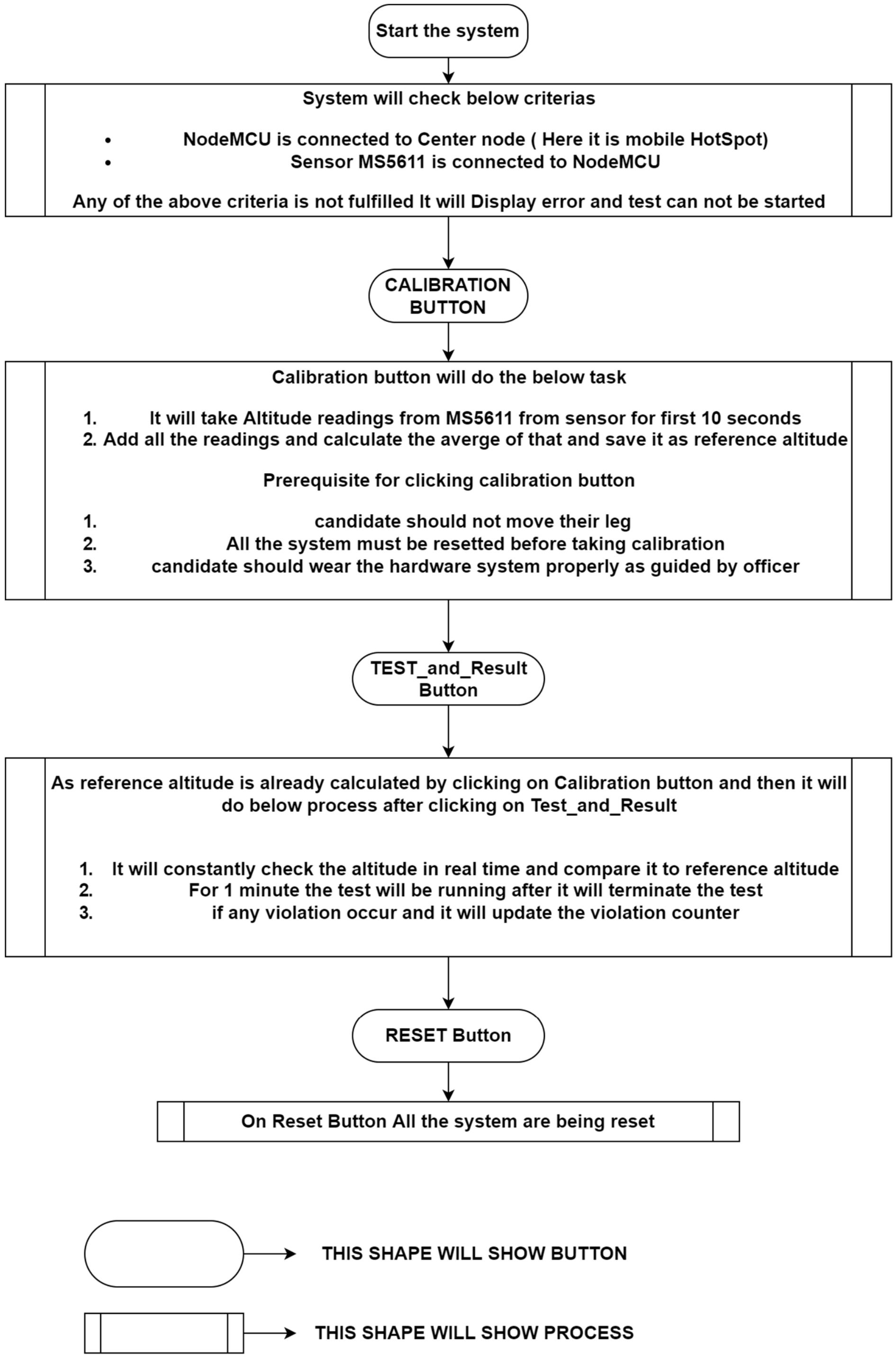

Fig 2. Block diagram of Software System Section

Details of each button are given below:

- **Button 1: Calibrate _start:** The state of button 1 is consistently implemented to ensure a successful test. When a candidate arrives for the test and has properly fitted the hardware to their feet, the officer will confirm that the feet are in contact with the ground. Subsequently, the officer will press Button 1 to initiate the calibration process. This process will take approximately 10 seconds to gather all necessary altitude data for calibration. After this duration, a message will appear indicating that calibration is complete, allowing the candidate to move their leg freely. This state of the button will record the reference altitude for assessing the condition of the feet's impact with the ground.

  Calibrate_done: This state of Button 1 will store the reference altitude and prompt us to continue with the next segment of the test.

- **Button 2: Test_Result_on:** By maintaining Button 2 in this condition, we will initiate the test. Upon clicking Button 2 in this state, the system will continuously monitor the altitude in feet throughout the test, unless either the maximum allotted time has elapsed, or the predetermined steps have been exceeded. If any of these conditions are met, this state of the button will provide us with the test results.

  Test_Result_off: This will indicate that the candidate's testing has been completed.

- **Button 3: Reset:** This state of Button 3 will restore the entire system to its initial position.

Hrdware section is shown in **Fig 3.** The hardware for the project has been optimized to enhance connectivity. The hardware system comprises three components: NodeMCU, Voltage Regulator, and MS5611 sensor. Let us discuss these components briefly. NodeMCU serves as the central processing unit of our system, handling all data received from the MS5611 sensor. As its name implies, NodeMCU stands for Node Micro Controller Unit. It is capable of transmitting data via WiFi. For initial system testing, we have connected it directly to a mobile hotspot. Even without an internet connection, we can utilize the Wi-Fi module of NodeMCU. In this case, we designate a central node, which is our mobile device. NodeMCU connects to the mobile hotspot, and the computer used to control the test must also be connected to the same mobile device. This setup allows for data transmission and test control without requiring internet access. To control the test, one must enter the IP address of NodeMCU into any browser on a device connected to the same hotspot. The second component, the MS5611 barometric sensor, provides altitude data. The third component is the Voltage Regulator, which is a buck-type voltage regulator. This converter reduces high DC voltage (ranging from 4.5 V to 50 V) to a lower voltage (between 3.0 V and 40 V). For our purposes, a 3.3 V supply is required for both the NodeMCU and the MS5611 sensor.

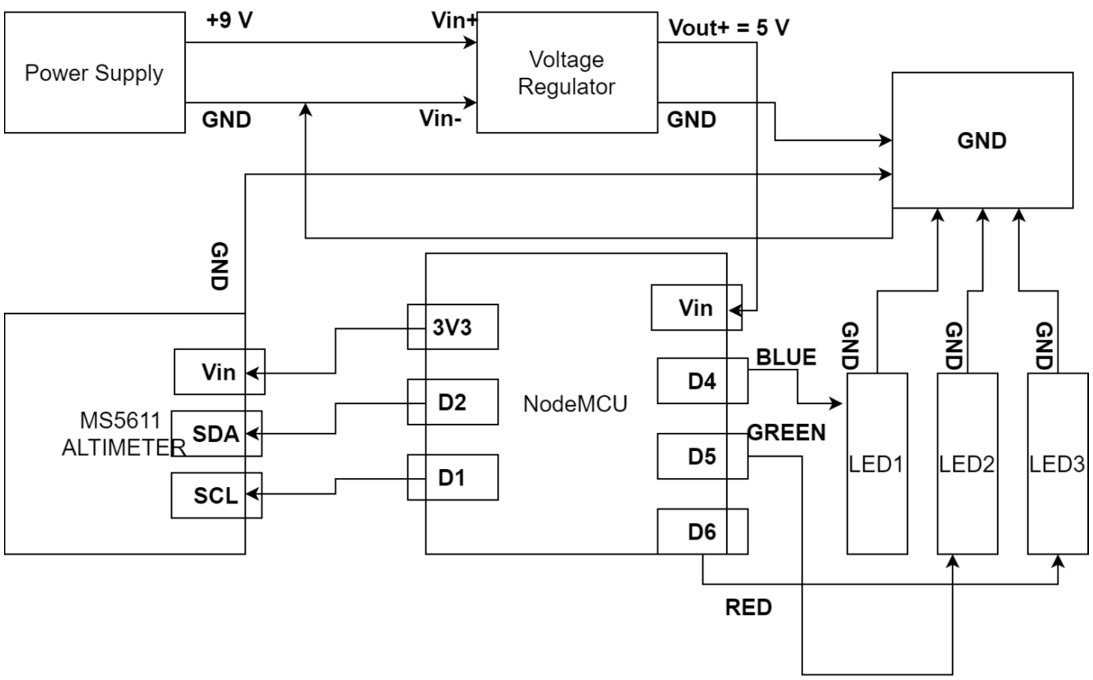

Fig 3. Block diagram of Hardware System Section

Fig 4. illustrates the web server interface from which we are managing the test. We have entered the IP address of the NodeMCU into the browser. The buttons, as mentioned in the previous section, are visible. These include Calibrate, Test_and_Result and Reset.

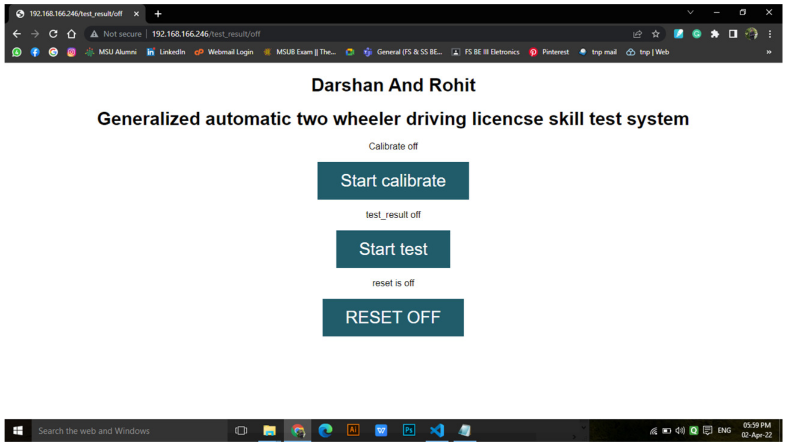

Fig 4. Display of Web Server

Fig 5. shows the schematic diagram of hardware circuit. For testing purpose, 3 LEDs are connected to show output of different functions. The flow chart of the code is illustrated in **Fig 6**. In the coding section, we began by verifying whether the system is connected to the web server. If it is connected, we proceed to check the sensor connection. Once all connections are confirmed successful, we calibrate the sensor for the reference altitude by clicking the appropriate button, after which we initiate the test for the designated duration. During this period, the code will monitor the altitude from the sensor and compare it to the calibrated value. By clicking on the test and result option, we can view the outcomes. This process can be better understood by examining the code flow chart.

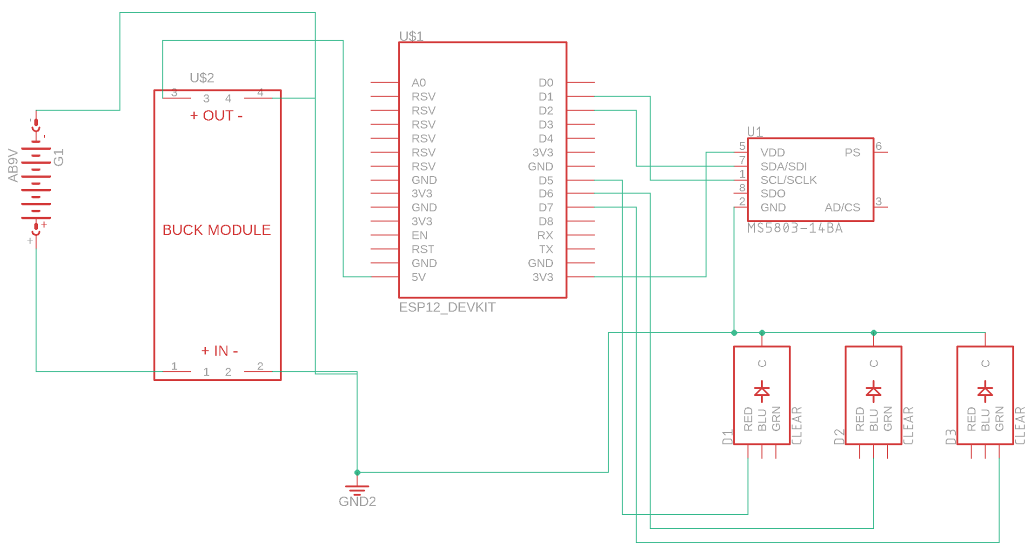

Fig 5. Schematic diagram Of Hardware System Section

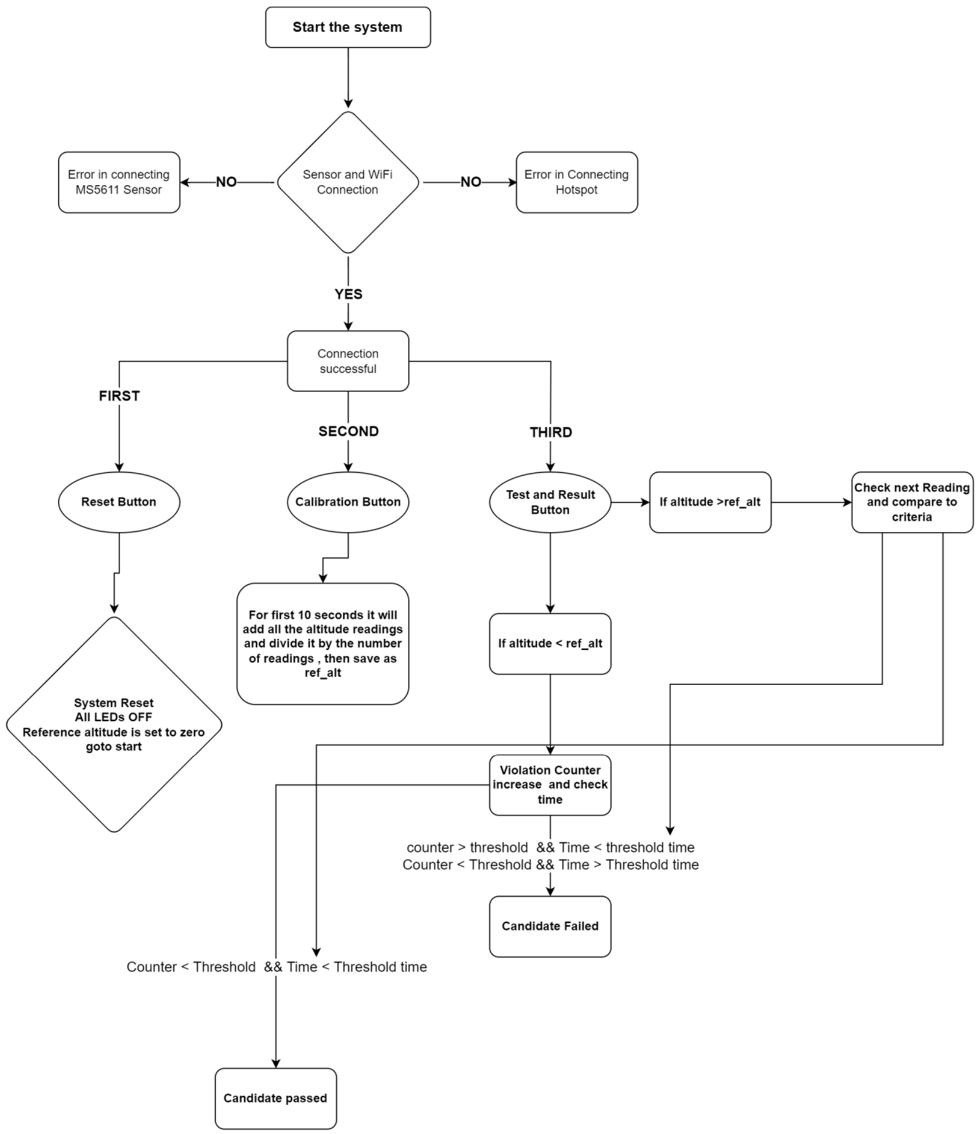

Fig 6. Code Flow chart

IV. SIMULATION AND TESTING

We commenced our work by finalizing the components while concurrently conducting initial testing. We faced numerous issues with components ranging from the microcontroller to the sensors. Initially, we examined the FSR (force sensing resistor), but it proved to be quite fragile, often breaking after two or three tests. Consequently, we concluded that we required a contactless sensor capable of detecting violations without any physical contact with the ground, leading us to select the MS5611 sensor. Regarding the microcontroller, we needed one that was compact and offered a good range for wireless connectivity, making NodeMCU and ARM the most suitable options. We opted for NodeMCU over ARM due to its integrated WiFi module, which is advantageous for the initial testing of the system we are designing. Nevertheless, we are confident that ARM will provide a superior advantage in further development. Additionally, we began with the nRF module, but due to its numerous limitations, we transitioned to Wi-Fi.

For testing, we have connected a 9 V battery to the voltage regulator and adjusted the output voltage to 3.3 V, which will serve as the input voltage for the NodeMCU and MS5611. Ensure that the NodeMCU is connected to the mobile hotspot. Subsequently, the IP address of the NodeMCU will be visible in the serial monitor. Copy and paste this address into any web browser (Note: The controlling device must be connected to the same hotspot). You will observe multiple buttons. At this point, provide the hardware to the candidate for mounting on his or her leg. It should be positioned between the ankle and knee joint to ensure better accuracy. For this test, we are holding the system in hand. First, click on reset to initialize the system. Place the hardware on the ground. Then, click on the calibrate. During the calibration process, do not touch the system. The calibration will take approximately 10 seconds to complete. Once the reference level is displayed in the web browser, we can commence the test. Next, elevate the system to about 30 CM above the ground, which is the typical distance between the ground and the leg base of any two-wheeler vehicle. Click on test and result. For a limited duration (in this case, 1 minute), the system will monitor the altitude data and compare it with the reference altitude. According to the code flow chart, if any violation condition occurs that meets or exceeds the threshold value, the result will be as specified in that segment. Since we do not have precise measurements, we have set the threshold value to a slightly higher range; otherwise, if the foot contacts the ground, the candidate would be immediately rejected. The sensor lacks precision, so there are instances where a violation is detected even when there is no contact between the ground and the leg. **Fig. 8** shows the Front PCB pictorial view and **Fig. 9** shows the Back side PCB Pictorial view.

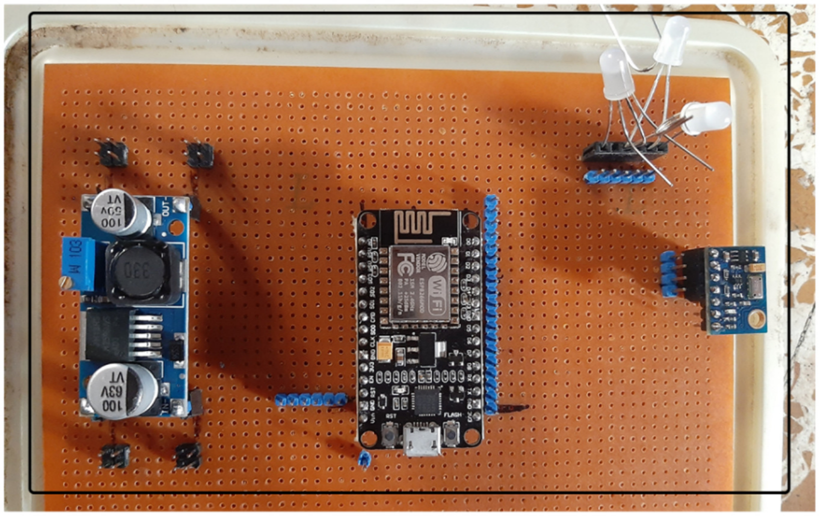

Fig 8. Front side PCB Pictorial view

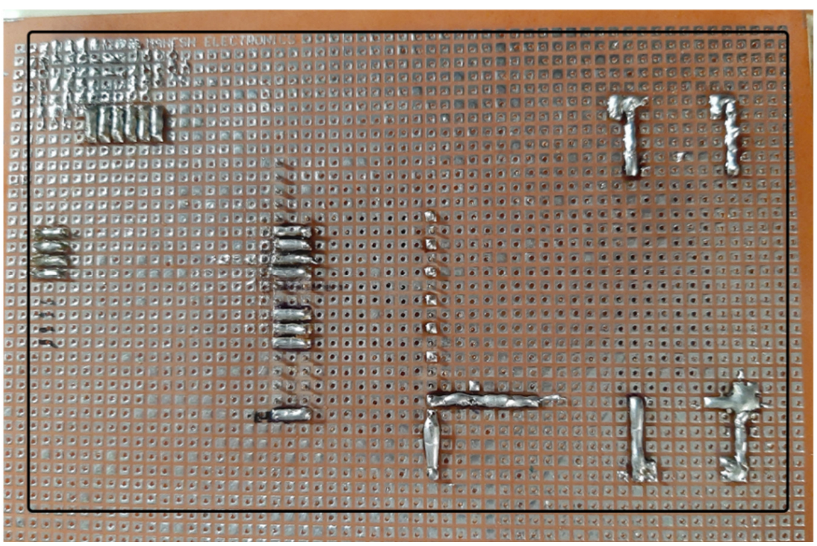

Fig 9 Back side PCB Pictorial view

V. CONCLUSION

As previously stated in our project objectives, we are developing a system to automate the skill test for two-wheeler driving licenses. Therefore, if a candidate completes the track within the designated time without their foot touching the ground, they will pass the test; otherwise, they will fail. This system operates wirelessly, as we have indicated. The system will perform all calculations automatically, with the officer simply issuing commands from their device to switch the test mode.

The primary aim of the project is to automate the current RTO system, ensuring its initial application at that location. Additionally, this system can be adapted to track the number of jumps performed during exercise for health monitoring purposes. It can also count the number of stairs climbed when ascending any staircase. Advantages of using this system are:

- No line of sight is needed while conducting test
- Test can be controlled from anywhere as its Wi-Fi enabled
- Less human force is required
- No limitation on track shape
- Real time data monitoring and data can be saved for proof.

The constraints of this system include:

- Due to the sensor's lack of precision, it may register a violation even when the foot is not in contact with the ground. However, this issue can be resolved by incorporating a gyroscopic sensor and simultaneously monitoring the data.
- The pressure may fluctuate as the vehicle's speed changes, but this can be addressed by enclosing the sensor to protect it from air interference, allowing only essential openings for air circulation.
- At present, the system is not connected to the internet; however, it can be linked by installing a common router, or its range can be extended by adding an additional NodeMCU within the coverage area.
- Our focus has been on developing the system primarily for one leg, and since this system is functioning effectively, we plan to replicate it for the other leg as well. Before doing so, we must also reduce the size of the PCB.
- Furthermore, when we implement the system for both legs, we will need a router to serve as the central node for both NodeMCUs and to manage the system.
- Additionally, since we have not yet connected to the internet, each time we execute the code, we receive a new masked IP address for the NodeMCU. The first two segments, 192.168, remain constant, while the last two segments vary. Therefore, we need to establish a method for setting fixed IP addresses and enhance the system's security through login and password-based authentication for both the candidate and the relevant officer.

The future scope of this proposed system includes further advancements in the project. If the limitations we have identified in each iteration are overcome, the project can be implemented in an actual RTO track. Additionally, we have constructed it on a Zero PCB; however, if we could have the PCB printed by any PCB manufacturer, it would be advantageous. This change would also significantly reduce the size of the system, allowing it to potentially fit on a leg with straps.

The "Generalized Automatic Two-Wheeler Driving License Skill Test System," as its name implies, aims to automate the existing RTO system. This initiative does not intend to replace the current system; rather, it seeks to automate it, thereby alleviating the burden on officials and making the process more cost-effective, as it can be conducted at any location designated by the RTO. Through the completion of this project, we have acquired numerous skills, including soldering various electronic components, coding for the website, and connecting it to actual hardware. Furthermore, we have gained an understanding of how to design a circuit using software. We faced several challenges while finalizing the components, but we have made every effort to complete the project. Additionally, we have learned how teamwork can be instrumental in achieving any task.

REFERENCES

[1] A Smart Driving License System in RTO Using Quantum Machine Learning Techniques, M. Mala, A. Ashwini, J. Jayapratha, E. Vimala, International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Volume 8, Issue 07.

[2] Automatic Two-Wheeler Driving Licence System by Using LabVIEW, Sarathkumar, C. K Sathish Kumar, Nithya, E.Thilagavathi, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 5, Issue 4, April 2016, ISSN (Print): 2320 – 3765, ISSN (Online): 2278 – 8875.

[3] Automatic Driving Test for License Issue, Mohd. Zaheer Faizi, Vishweshkumar Aithal, Sneha Nargundkar, International Research Journal of Engineering and Technology, (IRJET), Volume: 05 Issue: 09 Sep 2018.

[1] MS5611 Data sheet and precision altimeter calculations by Amsys “https://www.amsys-sensor.com/downloads/notes/ms5611-precise-altitude-measurement-with-a-pressure-sensor-module-amsys-509e.pdf”

[2] Two Wheeler driving license skill test criteria for passing or failing by RTO Office (Article from Ahmedabad RTO) “https://gujaratdrivinglicence.com/driving-track-information.php”

[3] Number of Fake License article published by Times Of India Quoted by Honourable Nitin Gadkari , Road and Transport Minister “https://timesofindia.indiatimes.com/india/30-of-driving-licences-in-india-are-fake-gadkari/articleshow/57960086.cms”