Development of Test RIG for Automated Driving Test Track and Issuing License Using LabVIEW

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Abstract:-The methodology presented in this paper facilitate the efficient and transparent way test for obtaining a drivers license. The new technology based on LabVIEW eliminates human intervention and improves the driving test accuracy while going paperless with Driving Skill Evaluation System. This system is aimed at phasing out the current manual test procedure.

Keywords:-*LabVIEW, Data acquisition, Sensors, Driving License, GUI*

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1. INTRODUCTION

Despite continued endeavor made at the state governmental level, various international and national organizations continue to report the vulnerabilities happening on the roads by flawed process of issuing driving licenses across India. According to a study conducted by the International Finance Corporation (IFC), the process of obtaining driving license in India is a distorted bureaucratic one.
The independent survey performed indicated that a close to 60 percent of license holders did not even have to take the licensing exam and 54 percent of them were unqualified to drive [1]. Driving license is in that category of public services that involves corruption of a nature involving more than the direct demand and supply of bribes between citizens and bureaucrats. In the context the corruption is centered on agents that work as intermediaries between the officials and citizens.

The study conducted by IFC also highlights the complex nature of corruption that exists in the process of issuing driving licenses. Hence we can say that the corruption in obtaining a driver's license can be minimized to a very large extent by developing an automated system which eliminates tampering of driving test results.

2. EXISTING TEST APPROACH

According to Motor Vehicle Act 1988, the candidate aspiring for a Light Motor Vehicle (LMV) license has to take up a theory test and a road tes

The theory test is a computer based test which involves the understanding of different road signals. Learner's License is issued after passing a theory test. Learner's License is a temporary license that is valid up to six months from the date of issue. It is basically issued to learn driving of Motor Vehicles. Permanent driving license is issued to those who become eligible for it after thirty days (to apply within 180 days) from the date of issue of the learner's license. In order to get Light Motor Vehicle (LMV) permanent driving license, the candidate should drive the vehicle on the 'H' track and also need to take up a road test. The layout of 'H' track is shown below

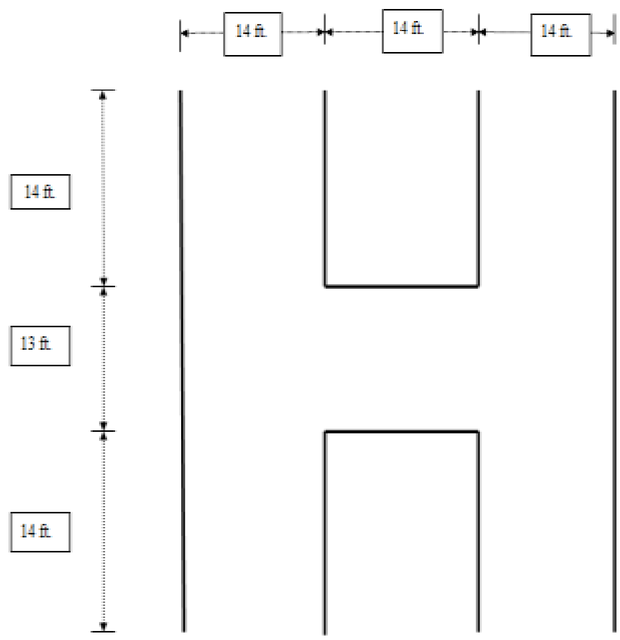

Fig 1: H Track Layout

The drive on the 'H' track by the candidate is also referred to as a ground test. The ground test is performed to evaluate the candidate's ability in controlling the vehicle. In the present ground test procedure, the 'H' track is implemented on the field using metal poles. The implementation of 'H' track on the field requires 12 metal poles.

A candidate is said to have a pass for the ground test, if the candidate completes the 'H' track without hitting the metal poles and also without crossing the line of intersection between metal poles. Monitoring of the current ground test requires human intervention. Hence it is possible to tamper the result.

3. SIGNIFICANCE

The limitations of manual driving test procedure are highlighted below,

- Since human intervention is required, the procedure is unfortunately vulnerable to fraud.
- The test result has to be manually entered into the Driver License Issuance System, allowing the possibility of human error.
- The test result is paper documented, requiring storage space.

The above limitations are solved by the new paperless driving test procedure. This system utilizes a Computer for monitoring the ground test procedure and has following features,

- The Computer act as a Driving License Issuance System which establishes real time communication with on-field 'H' track sensors.
- Reduce the need for staff to key in data, and eliminate the possibility of human error.
- On field monitoring of ground test by an officer is eliminated.

4. PROPOSED SYSTEM

The block diagram of the proposed system is shown in figure 2. The system consists of on-field automated H pattern, DAQ card and LabVIEW based test monitoring and result issuance system.

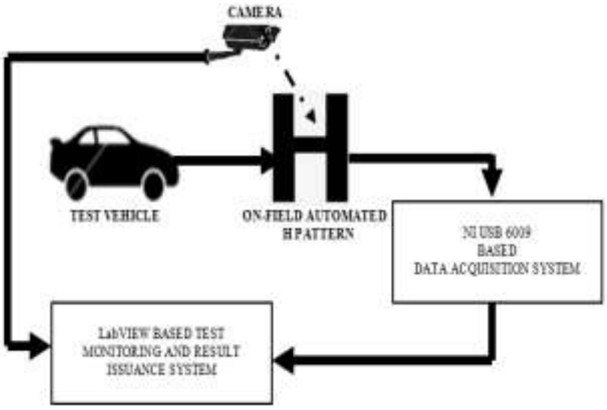

Fig 2: Block Diagram

The on-field 'H' track is automated using eight IR sensors. The on-field IR transmitter-receiver pairs are implemented using Rif50 photo sensors. Rif50 photo sensors are referred to as synchronized, self-aligning photocells. Self-aligning feature makes the sensor pairs free from centering problem. Synchronism feature allows the installation of two pairs of very close photocells, without them interfering with one another. It is also immune to interference from sunlight and has shockproof polycarbonate body. The layout of automated 'H' track using eight IR transmitter-receiver pair is shown in figure 3.

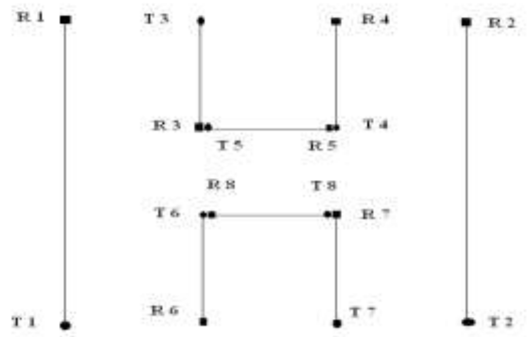

Fig 3: Automated on-field H pattern

The information regarding the sensor alignment is acquired by LabVIEW based monitoring system using NI USB 6009 DAQ card. In addition to this, the LabVIEW based standalone system performs visual monitoring of test vehicle movement on the 'H' track and generation of test report for the candidate.

4.1 LabVIEW Based Test Monitoring and Result Issuance System

This system monitors the candidates driving skill test on the automated on-field H track. The system is implemented using LabVIEW 2011. This also acts as a driving license issuance system because it enables the license seekers get the computer generated result sheet on the spot. The LabVIEW test monitoring and driving license issuance system consist of three GUI – test seekers e-application (electronic – application) system, visual monitor and on-field H pattern sensor alignment indication system. The screen shots of LabVIEW based GUIs for e-application is shown figure 4.

Fig 4: Graphical User Interface for e-application

The above shown graphical user interface allows test seekers to enter their personal information necessary for driving license e-application. Initially the test candidate needs to complete all the fields shown in the above GUI. The system is designed to identify error(s) in the information submitted by test candidate. This involves identification of blank user entry fields, incorrect date of birth and the pincode. The test candidate can start completing all the fields mentioned in the GUI only after following message appears on the GUI: SYSTEM READY – FILL IN CANDIDATE DETAILS as shown in figure 5.

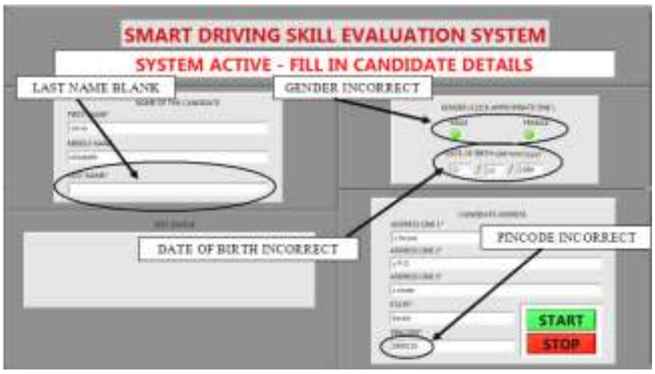

Fig 5: GUI with incorrect information

Once the user submits the test candidate personal information by pressing the START button, the system verifies all fields. After the verification of all the fields, the system pops up another window which will show the status of submitted information whether successfully completed the application or error(s) exist in the submitted application. If error(s) exist, then the window will also display message(s) regarding incorrect field completed by the test candidate. An example for such an instance is shown in figure 5. After pressing the START button for submitting the test candidate e-application, the system verifies and generates the pop up window as shown in figure 6.

Fig 6: Error(s) in submitted e-application

Here the pop up window display the messages regarding the incorrect information in the submitted e-application. To correct the error(s) in the submitted e-application, the OK button on the pop up window has to be pressed.

Fig 7: Incorrect fields cleared after the OK button pressed

Pressing OK button will take the user back to e-application page as shown in figure 7. To continue with the test procedure, the user has to complete all the fields without error(s) and submit it by pressing the START button. Now the message – SUCCESSFULLY COMPLETED THE APPLICATION appears on the pop up window as shown in figure 8

Fig 8: Success completed e-application

Once the e-application is completed successfully, the user has to press the OK button to continue. On pressing the OK button, the system will give an option for the user to cancel or continue further with the test process as shown in figure 9. To continue with the test process the user has to press the SUBMIT button or press the cancel button to cancel the test process. When the CANCEL button is pressed, all the fields in the e-application will be cleared for the next test candidate.

Fig 9: Submit and Cancel option with e-application

On pressing the SUBMIT button, the information regarding the test candidate will be registered with the system for the generation of test result sheet and then the candidate can move to the test vehicle for the drive on automated H-track. Once the test candidate has successfully completed the drive on the automated H track, the STOP button has to be pressed. On pressing the STOP button, the status of driving test will be displayed on the monitor as shown in figure 10.

Fig 10: Result of Passed test on the Screen

The system will also ask for test report generation, if the report needs to be generated then the YES button has to be pressed and if not then the STOP button has to be pressed. On pressing the YES button, the computer will ask the operator for saving the test report as a MS word document with file extension .doc and the location where the file has to be saved; this is shown in figure 11. Once the test report is saved the system automatically initializes and makes the e-application ready for next person. If the NO button is pressed then the system will not save the test report and instead directly makes e- application ready for the next test candidate. During the initialization it clears all the fields of e-application and checks whether all the sensors in the automated H-field is aligned or not

Fig 11: Saving the test report

The screen shot of saved driving test result report is shown in figure 12. The test result card shows the date and time of the test process, the test status whether passed or failed and finally shows all the personal information of the test candidate given in the e-application during the test procedure.

Fig 12: Picture final test result sheet

The alignment of sensors in the automated H-field is monitored using the GUI shown in figure 13

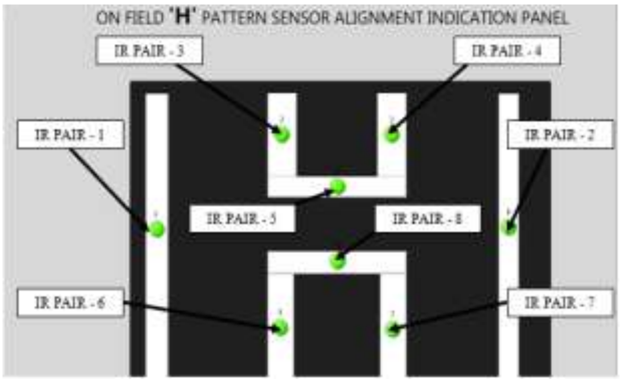

Fig 13: GUI for monitoring automated H - track

Here the status of all the eight IR transmitter-receiver pairs on automated H-track is mapped on to the GUI shown in figure 13. The mapping of on-field IR transmitter-receiver pairs is done in accordance with the layout as shown in figure 3. The GUI indicates the alignment of all the IR sensor pairs and if any of the sensor pairs are misaligned, the GUI displays a text based message regarding the misaligned sensor pair as shown in figure 14

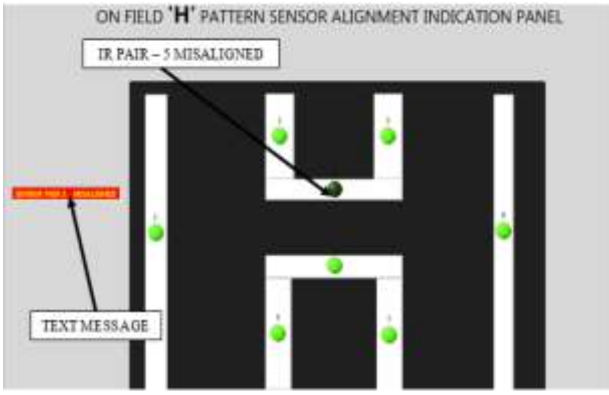

Fig 14: Misaligned sensor status with Graphical User Interface

The sensor pair alignment on the GUI is indicated using 8 LED indicator. The ON status of LED indicates that sensors are aligned and OFF status indicates that sensors are misaligned. An example for such an instance is shown in figure 14, here the LED indicator corresponding to sensor pair 5 is OFF which implies that IR sensor pair 5 on the automated H-track is misaligned. In addition to this, the GUI provides text based message regarding the misaligned IR sensor pair. This feature reduces the difficulty in finding the misaligned sensor pair installed on the automated H-track. The operation of this GUI and e-application GUI are inter-dependent. If any of the IR sensor pair is misaligned then the e-application GUI will not accept the information regarding the test candidate on pressing the START button. The e-application GUI will appear as shown in figure 15.

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Fig 15: e-application GUI when sensor(s) misaligned

So when the sensors are misaligned the e-application GUI will display the message: SYSTEM READY – SENSORS MISALIGNED. This feature allows the system to accept the candidate information only when all the sensors are aligned. After correcting the sensor alignment on the automated H-track, the system will accept the test candidate information on pressing the START button. If the application is successfully completed, then system again checks the alignment of on-field H track sensor pairs.

Fig 16: Graphical user Interface with misaligned sensor status after submission

If the sensor(s) are again misaligned then the e-application GUI will display the message: SYSTEM ACTIVE – SENSORS MISALIGNED which is shown in figure 16. This feature ensures that all the sensors are aligned before the test candidate drives on the H-track, thereby increasing the accuracy of the test monitoring system. The LabVIEW Block Diagram implementation for the GUI monitoring the IR sensor status on the automated H-track is shown in figure 17.

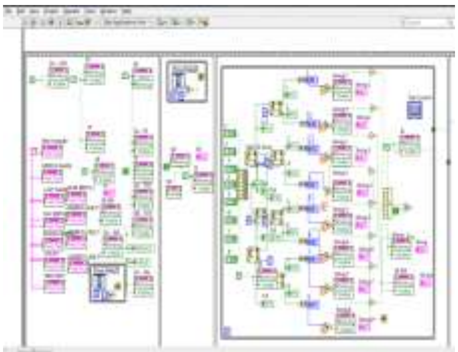

Fig 17: Block Diagram for monitoring on-field H track

The LabVIEW Block Diagram implementation for the e-application GUI is shown in figure 18.

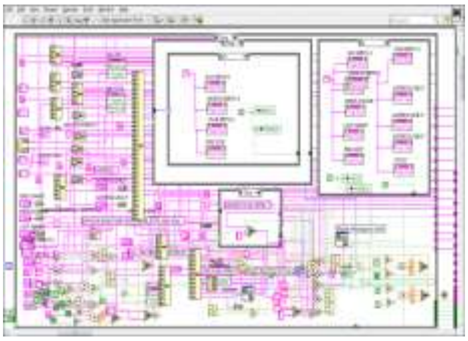

Fig 18: Block Diagram for smart e-application

Different array functions and structures like flat sequence, case structure, while loop and local variables are used in the implementation of the Block diagrams shown in figure 17 and 18. It displays the VI, its callers, and all of the subVI calls that it makes [6]. The hierarchical nature of the VI defines the power of LabVIEW. The hierarchical nature implies that a VI that is defined can be used as a subVI in the high level VIs [6]. Once a VI is coded, it can be used as a subVI in any application.

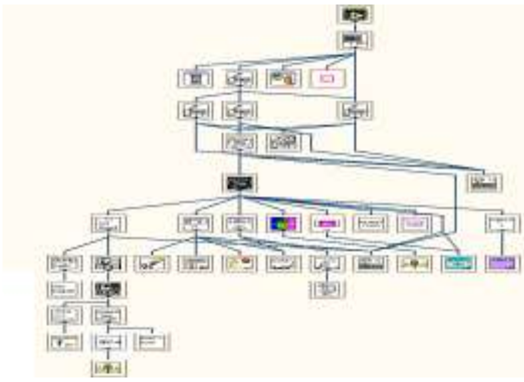

Fig 19: VI Hierarchy

4.2 NI USB 6009 Based Data Acquisition System

The data acquisition system consists of sensor output interface circuitry, logic level converter and NI USB 6009 DAQ CARD. The sensor output interface circuit attenuates the sensor output in the range of 0 -12 Volt to 0-5 Volt.

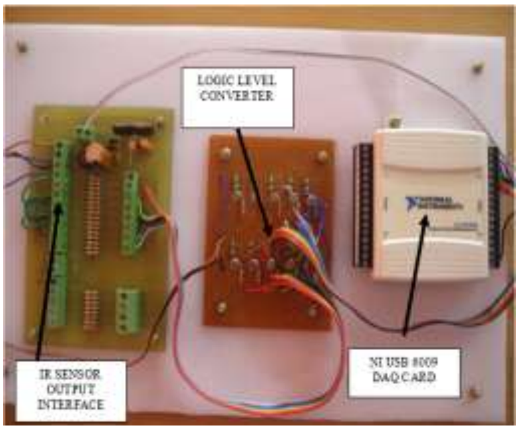

Fig 20: Representation of Data Acquisition System

The logic level converter is a transistor based switching circuit to provide proper TTL logic output. The TTL logic outputs from logic level converter are interfaced to digital I/O lines of NI USB 6009 DAQ CARD. Finally the LabVIEW based application on PC acquires the data from DAQ card via USB interface.

4.3 Visual Monitoring

The LabVIEW based visual monitor enables the monitoring of test vehicle motion on the automated 'H' track. This is implemented using vision and motion tool kit [7] in LabVIEW 2011 and 12 Mega Pixel High Resolution USB Webcam. Visual monitoring is implemented using NI Vision Acquisition Express VI.

5. CONCLUSION

This technology for skill assessment of obtaining driving license reduces corruption and thereby helps the government to select only the efficient drivers .Hence LABVIEW based system increases the level of transparency.

6. ACKNOWLEDGMENTS

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