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AN APPROACH TO IMPLEMENT ANALOG-TO- DIGITAL CONVERSION OF SPEEDOMETER USING VISION

Shweta Singh[*1], Yash Porwal[*2]

[*1,2]Affiliated by Rajiv Gandhi Technical University, Department of Information Technology, Acropolis Institute of Technology & Research, Indore, M.P, India

ABSTRACT

Ideas are never the same when we encounter them again. So, when we work with material multiple times over, we increase the chance of gaining value from the work just by having more exposure to the concepts. Today, with the increase in human population, number of vehicles has increased a lot as a result of which accidents are increasing day by day. So, a necessity of constructing devices that can be useful with their contributions is highly required. The project presents the use of modern IT to build a system that can convert analog reading of speedometer to digital reading. Digital speedometers, now a days are commonly used in most of the vehicles in order to sense and display their real time operating speed. Though, analog speedometers which were commonly used earlier until digital technology in vehicles started to play their part, also used to satisfy the purpose of measuring and displaying the speed of the vehicle, but were not as efficiently accurate as digital speedometers are. This implementation will detect dial and angle partitions of speedometer and by using angle, it will determine speed and show it digitally.

Keywords: Digital speedometer reading, Image processing, Open CV library functions like Hough Circles and Hough Lines, Hough Lines detect angle partitions, numpy library for numerical operations, flask framework.

I. INTRODUCTION

This is an era of Information Technology where getting information is the base of each and everything. The aim of this proposal is to implement a system that can show digital reading of analog speedometer using Open CV library of Python. As technology develops, nothing remains untouched. This project shows all kind of information that we usually had to look on different dials and can group them all in one place for better functionality. Another reason to choose this topic is that data is projected so that they won't distract the driver's attention like cell phones or dashboard controls do. Eyes refocus much faster when you switch from the road to the projected display that usually floats 15 feet in front of you. The digital speedometer is more efficient and less visually distracting for absolute and relative reading tasks.

During driving, drivers interact with the speedometer in a monitoring way for different purposes: maintain vehicle speed within safety margins, follow speed limit signs, carry out necessary adjustments (acceleration or deceleration), in overtaking situations, or in any driving environment in which speed plays a major role. Speedometer design has critical implications for road safety. With this, a misjudgment of speed can lead to rollover in a bend, jackknifing at braking, or swinging out on slippery roads. For those reasons, it is essential to carry out the speedometer design with the following objectives: provide accurate speed information in a quick way and avoid unnecessary mental workload increase. The aim of our project is to create an efficient low cost digital speedometer. It was inspired by the fact that most of the modern day vehicles use analog speedometers which have resolution of about 5 km/h and the range is also limited. Basically, this project reads position of speedometer's dial by image to give speed of vehicle as output.

II. METHODOLOGY

This part introduces our approach of creating a system which converts analog reading of speedometer into digital using Open CV library functions. The block diagram of proposed model is following:

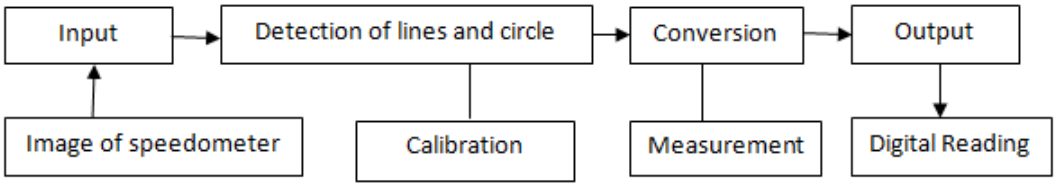

Figure:1 Block diagram of model

The proposed system will take an image of analog speedometer. By using OpenCV functions, it will read the value. This process will be done in two steps:

a) **Calibration:** During this stage, user needs to enter the range of speedometer values in degrees and model will calibrate the given image of speedometer.
b) **Measurement:** By using calibrated values, the model will calculate the digital value and show it as an output.

III. TECHNOLOGY AND LIBRARY

This section describes the technology, library and functions used to build the proposed system.

a) **Open CV:** Open CV is a python based library designed to solve computer vision problems. In this model, it will use numpy which is a highly optimized library for numerical operations with a MATLAB style syntax. All the OpenCV array structures are converted from numpy arrays. For the proposed system, OpenCV will use functions Hough Circles and Hough Lines.
b) **Numpy:** It provides a high performance multidimensional array object and tools for working with these arrays. Numpy is the core library for scientific computing in python.
c) **Hough Circles:** Hough Circle comes under circle Hough Transform (CHT). It is a basic feature extraction technique used in digital image processing for detecting circle in image. The circle candidates are produces by voting in the Hough parameter space and then selecting local maxima in an accumulator matrix. It is a method of Open CV package.
d) **Hough Lines:** It is also a method of Open CV package, cv2HoughLines is used for detecting lines from an image. In the proposed system, we have used it to detect the angle partition of speedometer's dial.
e) **Flask:** Flask is a web framework, it provides tools, libraries and technologies that allow you to build a web application. This web application can be some web pages, a blog, a commercial website or web- based applications. Flask is a micro- framework and it will have little dependency on external library. This enable us to update and watch for security bugs.

IV. RESULTS AND DISCUSSION

The result obtained during the implementation of model was satisfactory. The model was able to respond to its operation of measuring and displaying the speed digitally. This application takes the range of angle as user input and internally measures the speed value. The whole system uses python programming language. We have also used black- box testing in order to test the performance of application. Table 1 and Table 2 shows the test cases which were working completely fine.

Table 1. Test Case of Model\

Test Case ID	**TC001**
Test Case Summary	It will take an image of analog meter and detect the periphery of the speedometer.
Test Procedure	User needs to upload the file.
Expected Result	If the periphery is detected correctly, it will draw a circle and make marks of angles separated by 10 degrees.
Actual Result	The circle and marks over meter are marked.
Status	Pass.

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Table 2. Test Case of Model

Test Case ID	**TC002**
Test Case Summary	It will detect the position of dial in the meter which will help in evaluating the reading.
Test Procedure	Detect the dial in circle, the relative position of dial with the marks will give an angle made by dial which in turn is used to calculate the reading.
Expected Result	Reading should be accurate.
Actual Result	Almost accurate reading with just marginal error.
Status	Pass.

Figure 2 shows the input given by user on web application which is build by using Flask framework, user need to upload the image of any analog speedometer or gauge. Figure 2 shows the final output which is a digital reading of analog speedometer.

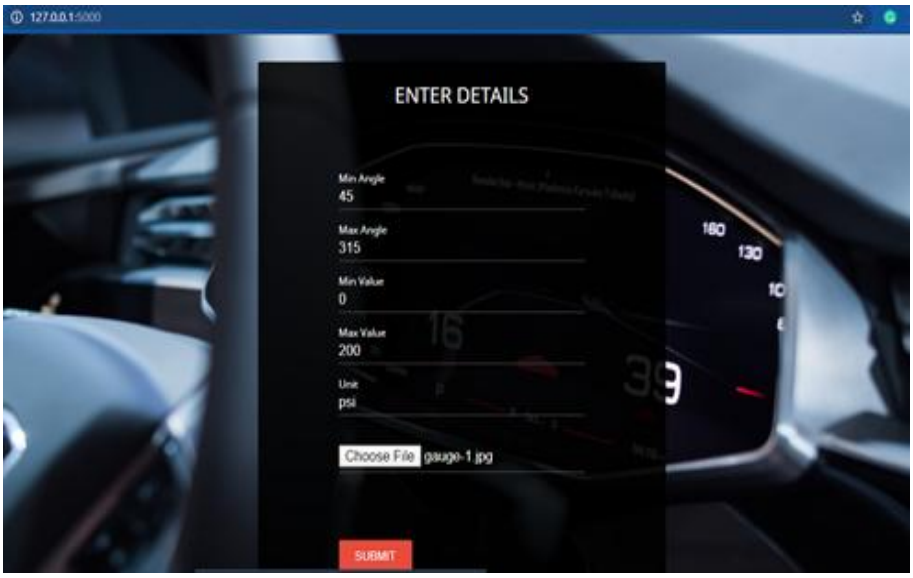

Figure 2: Input given by User

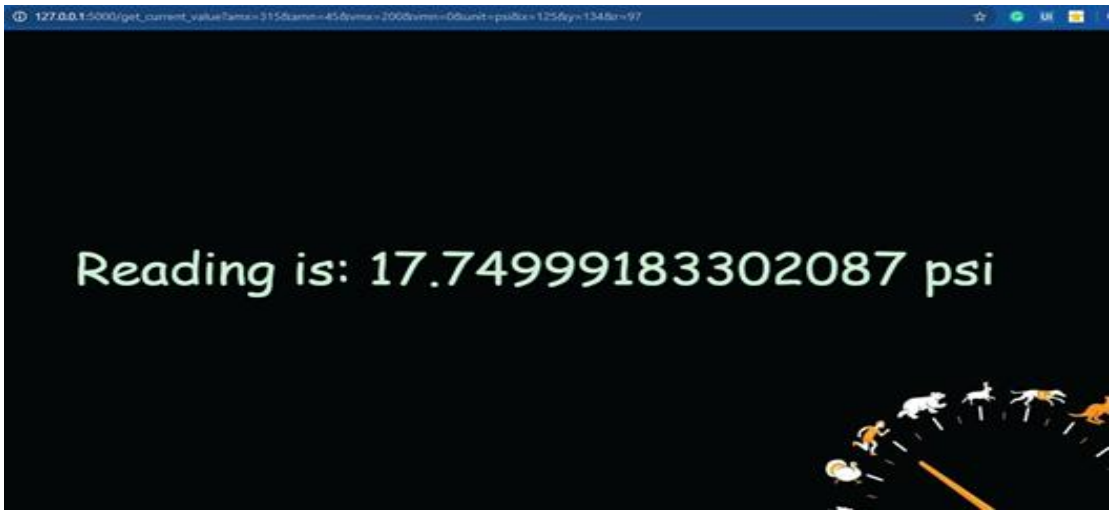

Figure 3: Output (Digital Reading)

V. CONCLUSION

As the world is growing and turning digital and much technologically advanced, the technology is making things easy and less complex for people. With help of this project we have tried to make it easier and more comfortable for car drivers, gauge readers that they can read the speed faster with less focus required to read an analogue one. The aim of the project is to implement a system which can give digital reading of analog speedometer which is fulfilled successfully. Though the proposed system will present a broad range of options to its users, some intricate options will not be covered into it like by modification, it can also be used as odometer, it can used for industrial machines reading measurement. This system is very useful for vehicles because it is cost- effective, life span is comparatively higher than analog speedometer, it reduce reading and interpolation errors and it is portable too.

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