# Numberplate Recognition Based Fuel Dispensing System

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***Abstract***— *The project "Numberplate Recognition Based Fuel Dispensing System" incorporates image detection, Optical Character Recognition, and Microcontroller Programming to create an efficient, quota-based fuel dispensing system for Sri Lanka. It aims to reduce labor costs and theft while enhancing safety and reliability. The system recognizes number plates using a Convolutional Neural Network trained on a dataset of 100 images, improving system accuracy. The number plate data is captured by a webcam and transferred to an Arduino microcontroller, which controls the fuel dispensing process. A DC Motor pumps the fuel, and a flow sensor measures the dispensed amount. Users are given a six-character password for system security. Real-time data about dispensed amount, total cost, and remaining fuel quota are provided to users. This project marks a step towards automated fuel stations, with future developments including an integrated payment system.*

***Keywords***— Convolutional Neural Network, Optical Character Recognition, Real-time Data, Microcontroller Programming, Image Detection.

## I. INTRODUCTION

They are in great demand as society continues to digitize and automate processes with streamlined flows and security features. Human lives are significantly impacted by automated systems. As a result, an automatic fuel delivery system is required. The system is no different. I set out to create an automated gasoline delivery system that is not only effective but also theft-free, safe, and user-friendly by using technologies like number plate recognition and microcontroller programming.

### *A. Background Importance of the study*

Traditional fuel distribution methods have a variety of shortcomings while being effective. They need a lot of labor and are prone to fraud and error by humans. The increase in the number of automobiles on the road exacerbates these issues. Therefore, a more efficient and secure fuel-distributing system is definitely required. In contemporary society, automation and digitalization are ongoing phenomena. This propensity has given rise to a number of chances for technological developments aimed at making life easier, safer, and more efficient. Such advancements may significantly benefit the petroleum distribution services industry. Automated fuel distribution systems have the potential to revolutionize the industry by reducing the possibility of human error, increasing production, and upgrading safety measures.

### *B. Project Overview and Scope*

The project, which makes use of Convolutional Neural Networks (CNN), Optical Character Recognition (OCR), and microcontroller programming, is an ambitious attempt to develop an Automated Fuel Dispensing System. I wanted to solve some of the main issues with conventional fuel distribution systems by automating the fuel dispensing process. A webcam-based number plate recognition system is included in the project's core. Tesseract for OCR is used to process the license plate data, which is then sent serially to an Uno board via a USB connection.

The Arduino then demands a password for further protection after successfully identifying the user. The system delivers the specified quantity of gasoline after successful authentication, and the user enters the required fuel amount. The project's consequences are extensive, and its successful implementation might significantly improve the effectiveness and consumer satisfaction of the gasoline service business.

## II. LITERATURE REVIEW

The ANPR system developed by Puranic, Deepak, and Umadevi (2016) was based on template matching, and it achieved an accuracy of 80.8% for Indian number plates. Their work provided an overview of various techniques used in ANPR systems and their respective applications.

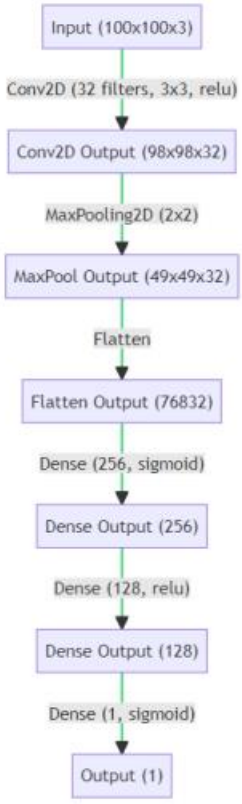
Further, Zhai and Bensaali (2013) proposed a standard definition ANPR system on FPGA and suggested an approach to extend it to high definition. Kocer and Cevik (2011) developed an ANPR system based on artificial neural networks. Ozturk and Ozen (2012) presented a new license plate recognition system based on probabilistic neural networks. Patel, Shah, and Patel (2013) provided an overview of ANPR systems in their survey. Moreover, Zhai, Bensaali, and Sotudeh (2012) developed an OCR-based

## III. SYSTEM OVERVIEW

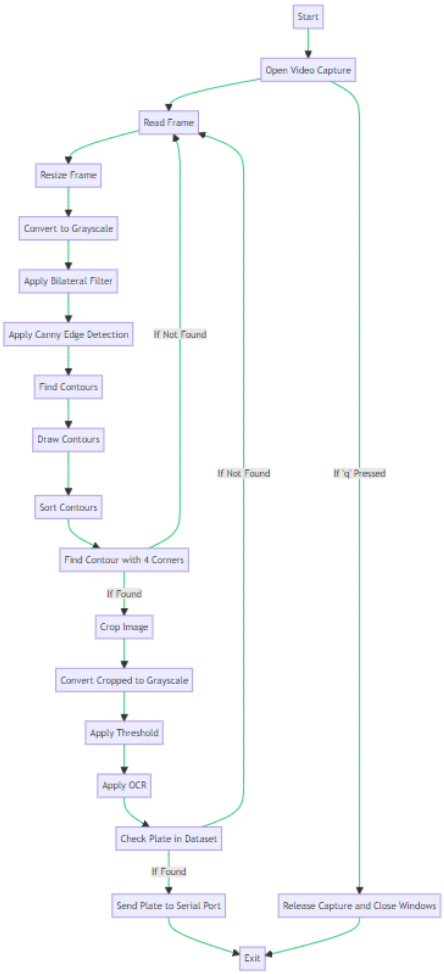
Combining techniques from machine learning, image processing, and microcontroller programming, the Fuel Dispensing System functions. The method begins by reading a license plate from a moving car. Convolutional Neural Networks (CNNs), a subset of deep learning algorithms created expressly for image processing applications, are used in this procedure. Using a dataset of

100 photos of licence plates in a certain format (BIK1234, FFT4567, ATM 2341 where the numberplate is believed to be in One row), CNN was trained to recognize the characters on the plates with accuracy. Following the webcam capture of the number plate picture, the image is prepared for Optical Character Recognition (OCR). OCR is a method for removing text from pictures. The Tesseract OCR engine is employed in this instance. The number plate picture is converted into text data by Tesseract and sent serially to the Arduino Uno microcontroller via a USB wire. The Arduino Uno recognizes the user after receiving the data by utilizing the pre-fed user data. The Arduino then requests a password from the user to increase system security. The user is permitted to enter the necessary quantity of gasoline if the password is validated. When the user inputs the fuel level, the Arduino Uno triggers a relay, which then turns on a 12V DC motor. The gasoline pump is driven by the DC motor to distribute fuel. A solenoid valve that may be adjusted depending on the user's needs (by pushing a button) regulates the rate of fuel flow. The Arduino Uno (2) determines the quantity of gasoline delivered in the last step. The GSM module SIM800L then transmits this data, together with details on the user's remaining quota and the overall cost of fuel, to the user's phone. This intricate but effective procedure illustrates how several technologies seamlessly combine to form a cutting-edge fuel dispensing system.

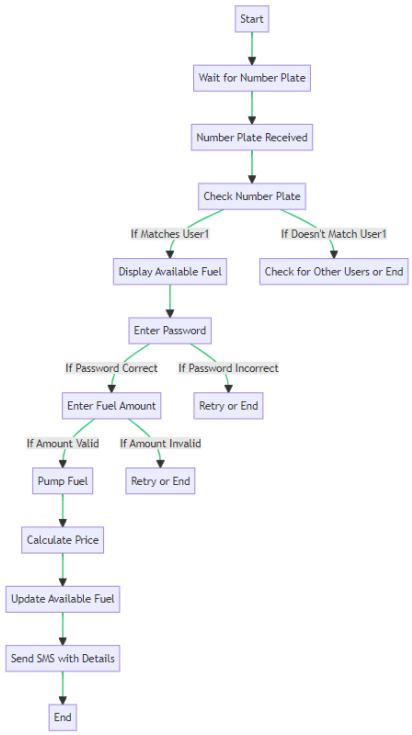
*A. Architechture of the CNN*




*B. Flow Chart of the Image Processing Task*




*C. Flow Chart of the Process in Microcontroller*



## IV. PROJECT OVERVIEW

### *A. COMPONENTS USED*

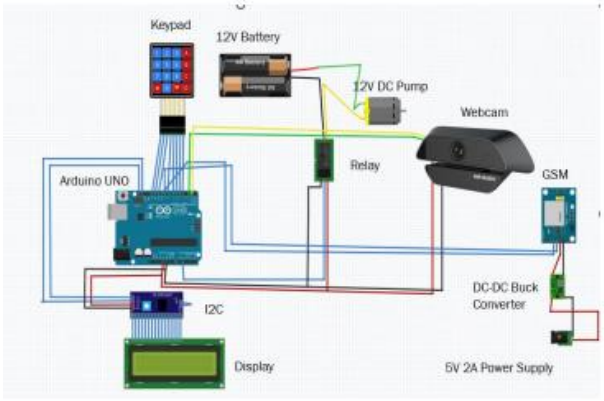
| **Component** | **Description** | **Use in the Project** |
|---|---|---|
| Web Camera | A digital camera that transmits the video over the internet or a computer network in real-time | Scanning the number plate of the car |
| Arduino Uno*2 | The open-source microcontroller board based on the ATmega328P chip | The microcontroller used to control the components in the project |
| SIM800L GSM Module | Enables GSM functionality in devices | Sending the summary of the fuel pumping quota and total price to the user's mobile phone as an SMS |
| 16*2 LCD Screen *2 | Alphanumeric display module with 16-character positions in each of its two rows | One LCD was used to give instructions to the user of the process and the other displayed the amount pumped measured through the Flow Sensor |
| 5V 2A SMPS Power Adapter | Converts high-voltage AC input from a wall outlet to a lower-voltage DC output | Supplying the required power to the GSM module to get it into the ideal operating conditions |
| 12V DC Submersible Pump | Compact pump that can withstand submersion and the corrosive effects of liquids | Pumping the fuel into the vehicle, the motor pumps 600L/H |
| Flow Sensor | Measures the flow rate of a fluid | Measuring the amount of pumped fuel |
| 12V DC Electric Solenoid Valve | Controlled by an electric current and operates on a 12-volt direct current (DC) power source | Controlling the flow of the incoming fuel pumped by the DC motor |
| Keypad 4 by 4 Module | An input device that consists of a grid of 16 buttons arranged in a 4x4 matrix | Entering the amount of fuel desired by the User and entering the password assigned for each user |
| Relay *2 | Electrical switch that is operated by an electromagnet | One relay was used to Control the DC motor through uno and the other was used to control the 12V Solenoid valve |
| I2C Module *2 | Communication module that allows devices to communicate with each other using the I2C protocol | Transferring data to the 2 LCDs |
| 18650 Rechargeable Batteries*3 | The lithium-ion battery gets its name from its dimensions: 18mm in diameter and 65mm in length | Main power Source which was used for the pumping process |
| USB Cable | A common type of cable used for connecting various devices to a computer or power source | Transferring the scanned numberplate Serially as data to the Arduino Uno |

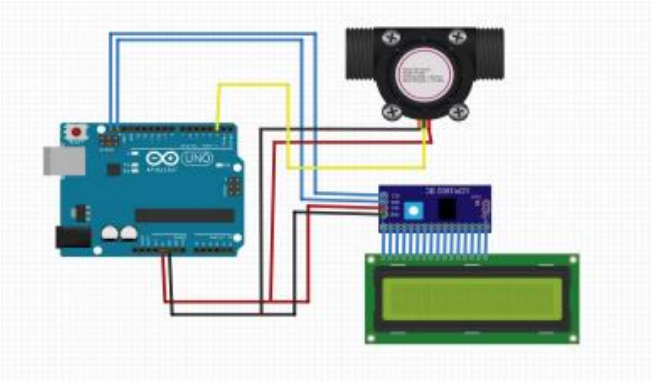
Figure 1 – Table of components

### *B. Circuit Diagrams*

Using Fritzing, a well-known open-source hardware project that makes the process of creating electrical circuits simpler, circuit schematics for the project at hand was painstakingly created. Both pros and amateurs may benefit from Fritzing's user-friendly interface and extensive component library. Two microcontrollers were strategically chosen for our design in order to maximize resource use and simplify the whole process. We were able to improve the system's functionality, effectiveness, and dependability by splitting the tasks across two microcontrollers. We were able to assign various duties to each microcontroller in this dual-microcontroller

configuration, avoiding resource conflict and assuring quicker, more efficient processing. The system's resilience is additionally increased by employing two microcontrollers. The system can still work partly even if one microcontroller has a problem since the other one can keep going. This prevents the system from failing totally. In crucial applications like gasoline distribution, where system failure might have detrimental effects, this extra layer of protection is a considerable benefit.



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*1) Level-1 Heading*: They should be in Uppercase, centered. The level-1 heading carries a number in Roman uppercase except for headings "REFERENCES", "ABBREVIATIONS AND SPECIFIC SYMBOLS" and "ACKNOWLEDGEMENT". For example, see headings "I. INTRODUCTION" and "ACKNOWLEDGMENT" of this document.

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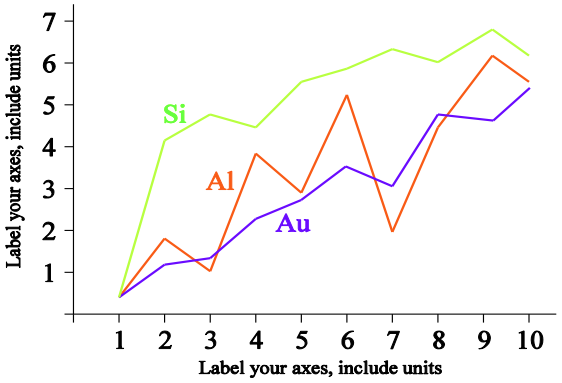


A line graph using colors
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Zhang S, Zhu C, Sin JKO, *et al.* (1999) A novel ultra-thin elevated channel low-temperature poly-Si TFT, *IEEE Electron Device Lett.*, 20, 569–571.

## ABBREVIATIONS AND SPECIFIC SYMBOLS

When any abbreviation occurs for the first time in a paper, it should be given in full words, followed by the abbreviation within parenthesis. Specific symbols should be treated in the same manner.

## ACKNOWLEDGMENT

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## AUTHOR BIOGRAPHY/IES

Akitha Thevmin Munasinghe Arachchige is an enthusiastic undergraduate student pursuing a degree in Electronic and Telecommunication Engineering at KDU. With a genuine passion for technology, Akitha actively participates in academic endeavors and practical projects related to electronic and telecommunication systems. Through coursework and extracurricular activities, Akitha has gained knowledge in wireless communication, signal processing, and networking. With a strong commitment to ongoing learning, Akitha strives to contribute to advancements in the field and apply technology to solve real-world challenges.