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Smart Traffic Light System with additional feature for Emergency Vehicles

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ABSTRACT: With increasing urban population and hence the number of vehicles, need of controlling streets, highways and roads is major issue. The main reason behind today's traffic problem is the techniques that are used for traffic management. Today's traffic management system has no emphasis on live traffic scenario, which leads to inefficient traffic management systems. These traffic timers just show the preset time. This is like using open loop system. If we incorporate a closed loop system using camera, it is possible to predict the exact time on traffic light timers. If the traffic light timers are showing correct time to regulate the traffic, then the time wasted on unwanted green signals (green signal, when there is no traffic) will be saved. Timer for every lane is the simplest way to control traffic. And if those timers are predicting exact time then automatically the system will be more efficient. This project has been implemented by using the MATLAB software and it aims to prevent heavy traffic congestion. This project measure the number of vehicles present on the road. Moreover, for implementing this project Image processing technique is used.

I. INTRODUCTION

Detecting and Tracking vehicles is an important and emerging research area for intelligent transportation systems. Image processing plays an important role in detecting vehicles from a traffic surveillance videos. Traffic monitoring through image processing leads to better control of flow of traffic as well as to identify reckless users and speed violators. Usually, Image Processing system includes treating images as two-dimensional signals while applying already set signal processing methods to them. Vehicle classification is an efficient technique used for transportation systems such as toll stations, traffic Intersections, traffic congestion avoidance, terrorist activities inspection etc. Different toll stations define a standard for classifying vehicles. This standard is based on different types of vehicles like two-wheeler, four-wheeler, heavy-motor vehicles. There are some standard hardware-based systems for detecting and classifying the vehicles coming near the toll stations like sensors, loop detectors etc. But the installation and maintenance charges are high, as the detectors are costly, can cause damage to the roads and would give limited information on the vehicles. Whereas using software-based classification, installation and maintenance is very cost effective as the detection is done using video frames or through static photographs take from the cameras installed in front of the lanes. Hence the technique of detecting vehicles using video frames is more advantages than other technologies.

Fast transportation systems and rapid transit systems are nerves of economic developments for any nation. Mismanagement and traffic congestion results in long waiting times, loss of fuel and money. It is therefore utmost necessary to have a fast, economical and efficient traffic control system for national development. The monitoring and control of city traffic is becoming a major problem in many countries. With the ever increasing number of vehicles on the road, the Traffic Monitoring Authority has to find new methods of overcoming such a problem. One way to improve traffic flow and safety of the current transportation system is to apply automation and intelligent control methods. As the number of road users constantly increases, and resources provided by current infrastructures are limited, intelligent control of traffic will become a very important issue in the future.

Traffic congestion may result due to heavy traffic at a junction. To avoid congestion there are so many traffic management techniques available. But no technique is perfect by itself as the real time situations are generally continuously changing and the system has to adapt itself to change in the continuously changing circumstances. We

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have made an attempt to provide some traffic management strategy which is self-changing in nature, so as to fit into continuously changing real time traffic scenarios. In this system, time is assigned to traffic light of particular lane according to the priority given to particular lane based on traffic density. Also we can indicate signal break in a particular lane or if there is an emergency vehicle stuck in traffic we can give first priority to that lane. If there is an obstacle LCD is used to display the message of obstacle detection to avoid inconvenience.

II. LITERATURE SURVEY

The related work can be generally divided into the following categories.

A. Sotiris Pavlopoulos, EfthyvoulosKyriacou,A Novel Emergency Telemedicine System Based on Wireless Communication Technology—AMBULANCE

This paper provides early and specialized prehospital management contributes to emergency case survival and a portable medical device that allows telediagnosis, long distance support, and teleconsultation of mobile healthcare providers by expert physicians.

B. Poonam Gupta, Avanti Patil, "Smart Ambulance System"

This paper illustrates about revolutionary development in the field of Internet of Things (IoT) and how it can be seamlessly & widely in large number of end system where subset of a large amount of data can be accessed and processed easily and powerfully.

C. Vishnu R. Kale, V. A. Kulkarni, "Object sorting system using robotic arm", Vol. 2, Issue 7, July 2013

In this paper a Fully functional sorter machine can be implemented by using a structure of parallel and independent channels in order to increase the overall throughput which results with a forecasted performance. The project can work successfully and separates different objects using sensors. The sensor handling systems which drive the pick and place robot to pick up the object and place it into its designated place can work if accurately designed. There are two main steps in sensing part, objects detection and recognition. The system can successfully perform handling station task, namely pick and place mechanism with help of sensor. Thus a cost effective Mechatronics system can be designed using the simplest concepts and efficient result can be observed.

D. J. D. Gavade , P. K. Kharat, S. K. Laga " Cost Effective Approach for Object Sorting", International Journal of Computer Applications (0975 – 8887) Volume 52– No.16, Augu2012

In this paper, An object sorting system for domestic/industrial control has developed using the concepts of Image Processing, Robotics Mechanism and parallel communication without help of DSP processor. The model developed is user friendly. Hence for fast manipulation the algorithm implemented in the PYTHONis suitable for our sorting problem. Result of sorting the object may not work for 100 percent but it is working for nearly 90 to 94% in case of our algorithm. It can be improved by increasing the accuracy and it depends on atmospheric factors.

E. Prof. D. B. Rane1, Gunjal Sagar S.2, Nikam Devendra V.3, Shaikh Jameer U.4, "Automation of Object Sorting Using an Industrial Roboarm and PYTHON Based Image Processing", International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 5, Issue 2, February 2015)

In this paper, the sorting machine sorts the objects depending upon the colours of the objects successfully with the help of the roboarm and PYTHONprogram in image processing. The USB webcam serves as an eye of the system which captures the real time image of the objects. The roboarm picks the faulty quality object and places it at predefined place, while good quality object continues its motion on mechanism belt and finally drops into object carrier system. In this LCD displays the object count with the status about the quality of the object. The servomotors used in the roboarm plays the vital role as control movement of the roboarm wholly depends control signal given to servo motor. Hence to operate the system accurately the synchronization between IR sensors, dc motors of the mechanism belt and roboarm is very essential.

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F. Vishnu r. Kale, 2V. A. Kulkarni," automation of object sorting system using pick & place robotic arm & image processing", Proceedings of 3rd IRAJ International Conference, 5th January 2014, Mumbai, India. ISBN: 978-93-82702-51-1.

In this paper, Fully functional sorter machine is implemented by using a structure of parallel and independent channels in order to increase the overall throughput which results with a forecasted performance. There are two main steps in sensing part, objects detection and recognition. The system is successfully perform handling station task, namely pick and place mechanism with help of sensor. Thus a cost effective Mechatronics system can be designed using the simplest concepts and efficient result is observed.

IV. PROPOSED SYSTEM

Proposed System Block Diagram For the real time traffic light control system image processing is the method used which overcomes the drawback of the previous standard methods. The vehicles are detected by the system through images instead of electronic sensors embedded in the pavement. A camera will be alongside the traffic light.

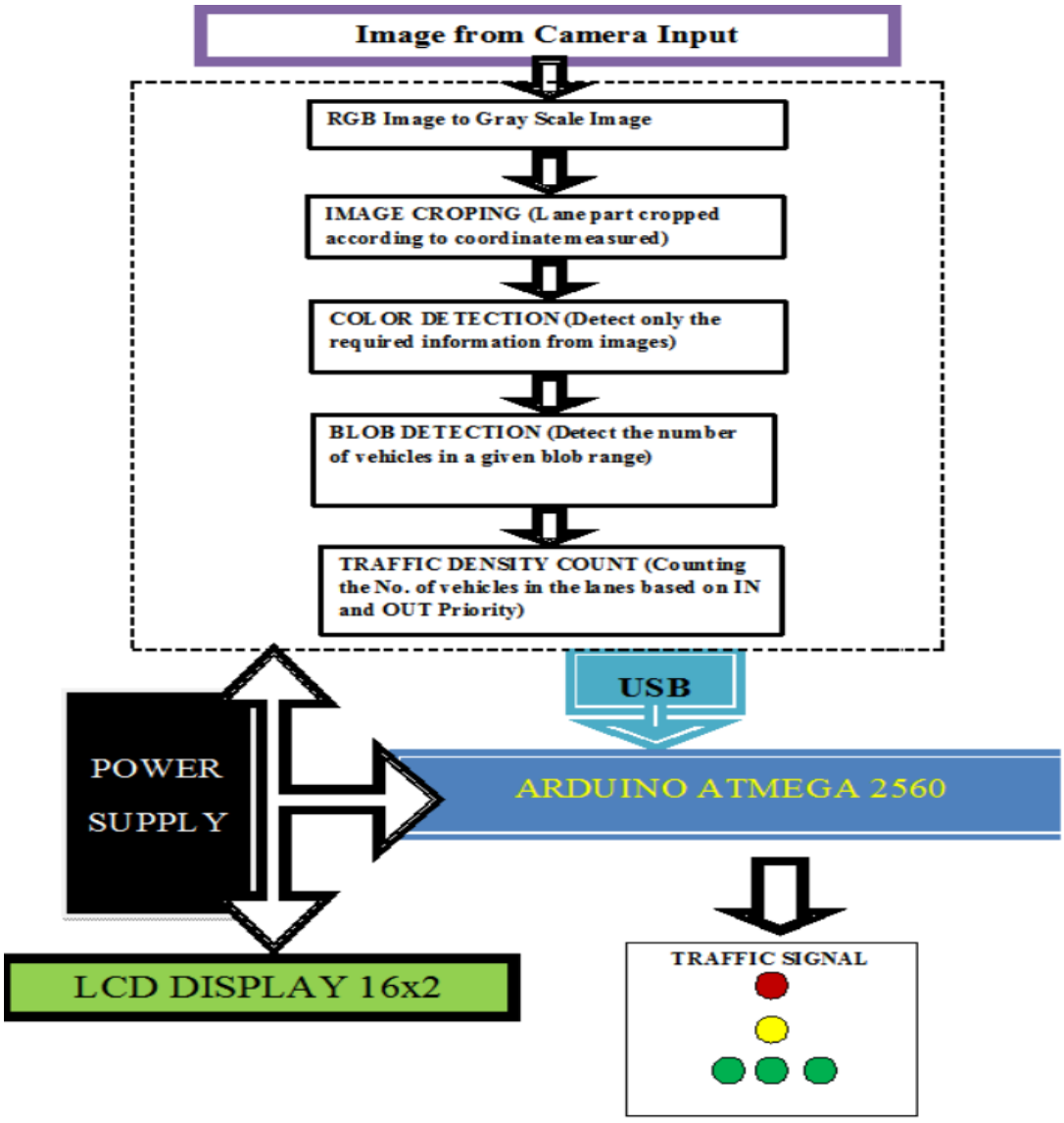

Fig. 1 System Architecture

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It will capture the image. Image processing is the better technique to control the state change of traffic light. It shows that it can decrease the traffic and avoids the time being wasted by the green light on an empty road. It is also more reliable in estimating vehicle presence because it uses actual traffic images. It visualizes the practically, so its functions much better than those systems that rely on the detection of the vehicles.

IMAGE ACQUISITION:

The work starts with processing of the captured images using MATLAB software. The camera is stationary, which is mounted on the pole near the traffic signal. This raw digital data is further processed by converting the images from RGB (Red- Green-Blue) to grayscale in order to further process the images.

Figure. 2 Image Acquisition

IMAGE CROPPING:-

The second step is to select the targeted area by designing image cropping algorithms in MATLAB. The purpose of cropping is to identify the road (lane) region where the vehicles are present and exclude the unnecessary background information. This unnecessary information is fixed in every frame of the captured pictures.

COLOR DETECTION:

The concept of color detection is, as the name suggests, a part of image processing that involves differentiation between objects based on their color. If we are processing an image with a number of colored objects, and we want to process only the ones of a particular color, then color detection methods basically return a binary image where only the portions with relevant color are white, while the rest is black. This reduces the information of the image to only the relevant portions, which make it easier to process for various operations.

BLOB DETECTION:

Blob detection methods are aimed at detecting regions in a digital image that differ in properties, such as brightness or color, compared to surrounding regions. A particular range is mentioned which determines that the object will be counted further if it lies within the range or else it will be considered as noise image and will befiltered out.

OBJECT COUNTING:

To count the objects present in the image, the close boundaries of the objects are identified. The exterior boundaries of the objects as well as the boundaries of holes inside these objects in the binary image are counted to identify the vehicles which are present in the targeted area.

TRAFFIC DENSITY:

The next step is to calculate the traffic density in the desired target area. The Traffic signals are handled based on the outline density of the lanes of the traffic

Steps:

The duration of the traffic signal is monitored as follows:

1) The camera takes pictures of the all the 4 lanes defined in the range specified. The pictures are transferred to MATLAB for further Processing.

2) The images are processed in MATLAB and the signal time for the road is decided as per traffic density.

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3) The duration of the green signal to a particular lane is determined based on the traffic density of the Lane. The more traffic in lane the more time green signal will be ON. This is done to avoid the problem of lanes congestion.
4) This process repeats and the duration of green signal given to each lane keeps adjusting itself every time the traffic is monitored by camera and the processing of the same is done.

In case of emergency vehicle:
1)The emergency vehicle is given the highest priority.
2)The emergency vehicle is detected through color detection.
3)As soon as an emergency vehicle is detected, the signal light turns green and allows the emergency vehicle to pass.
4)The system resumes to its normal working after the green light time for the emergency vehicle is elapsed.

IV. RESULT AND DISCUSSION

The system/prototype works successfully.
The number of vehicles is determined and can be seen in the GUI (graphical user interface).
The signal time is altered according to the traffic density.
In case, a red vehicle(emergency vehicle) is detected, the signal turns green immediately.
The system resumes to its normal working condition in few seconds.
The system working is demonstrated through pictorial presentation below.
1] Setting background image:

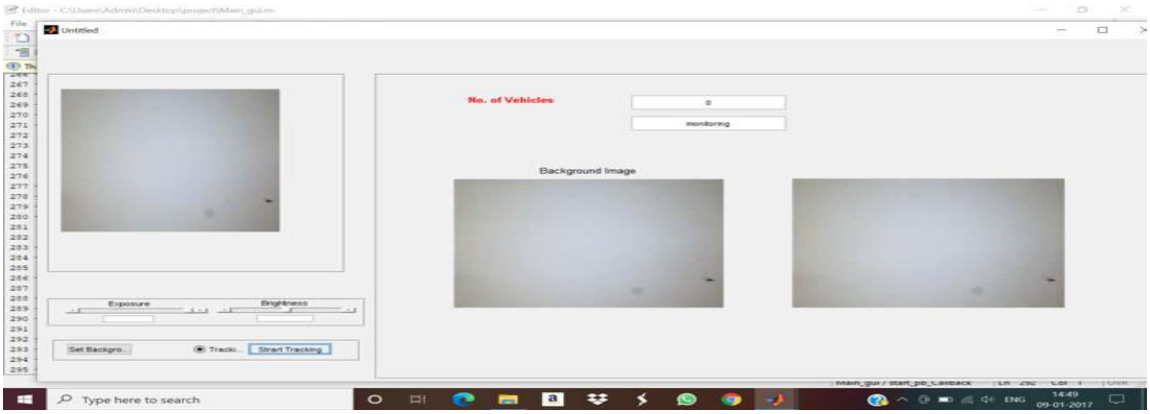

Fig. 3 Setting background image

2] When 1 vehicle is placed:

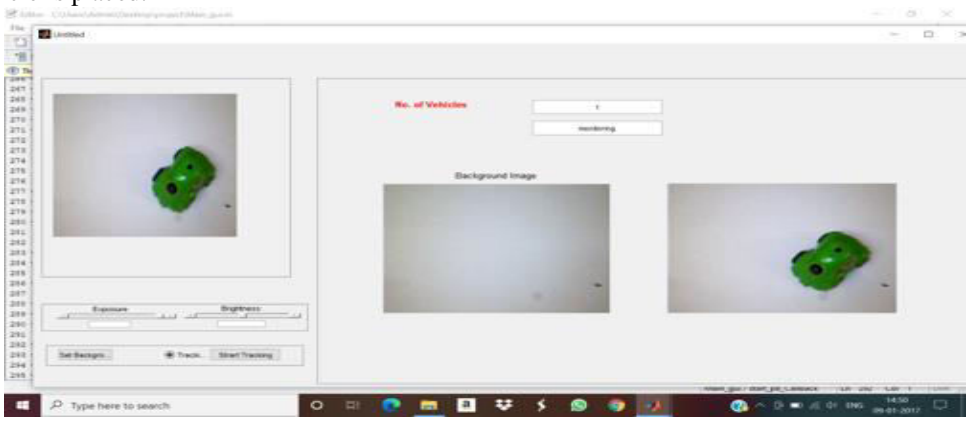

Figure 4. one vehicle Output

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3] When two vehicles are placed:

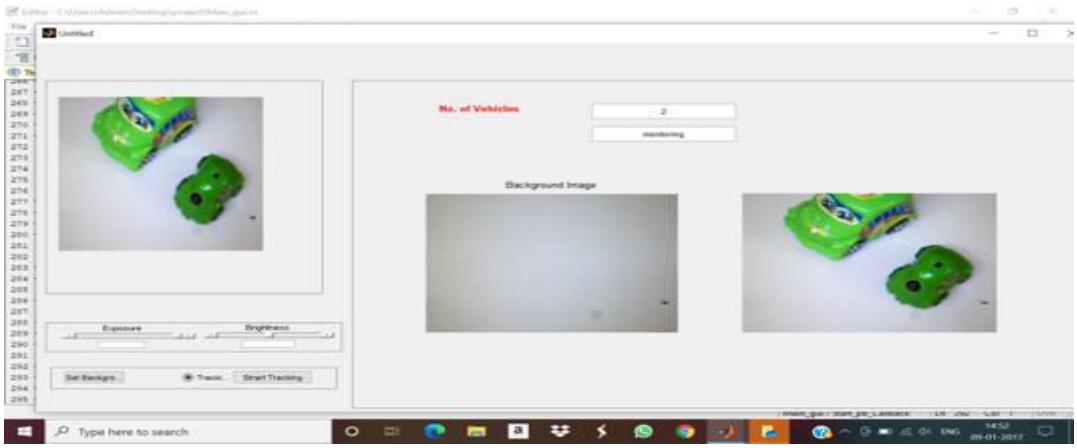

Figure 5. Two vehicle Output

4] When emergency vehicle is detected:

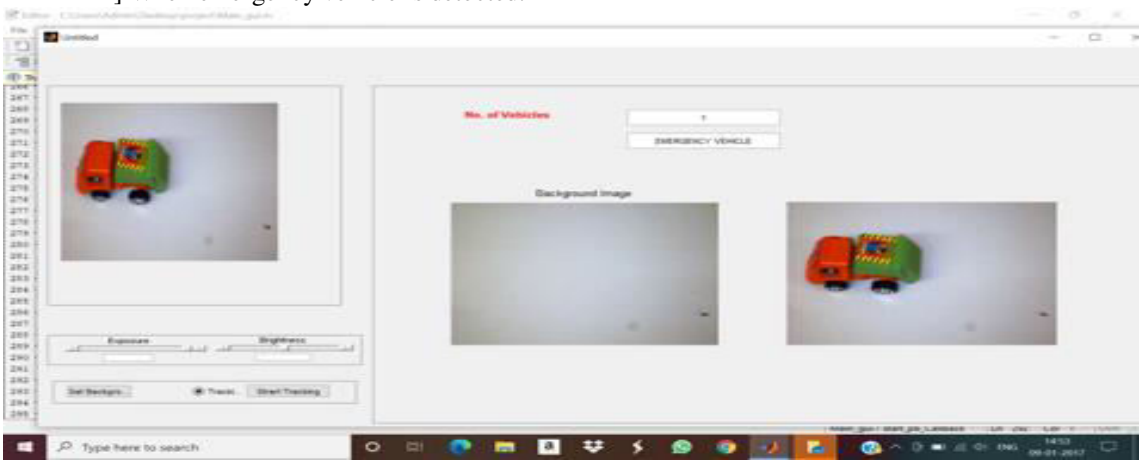

Figure 6. Emergency vehicle Output

V. HARDWARE & SOFTWARE USED

- ATMEGA328P MICRO CONTROLLER
- LED
- CAMERA
- LAPTOP
- POWER SUPPLY
- MATLAB

VI. CONCLUSION

The study showed that image processing is a better technique to control the state change of the traffic light. It shows that it can reduce the traffic congestion and avoids the time being wasted by a green light on an empty road. It is also more consistent in detecting vehicle presence because it uses actual traffic images. It visualizes the reality so it functions much better than those systems that rely on the detection of the vehicles' metal content. Overall, the system is good but it still needs improvement to achieve a hundred percent accuracy.

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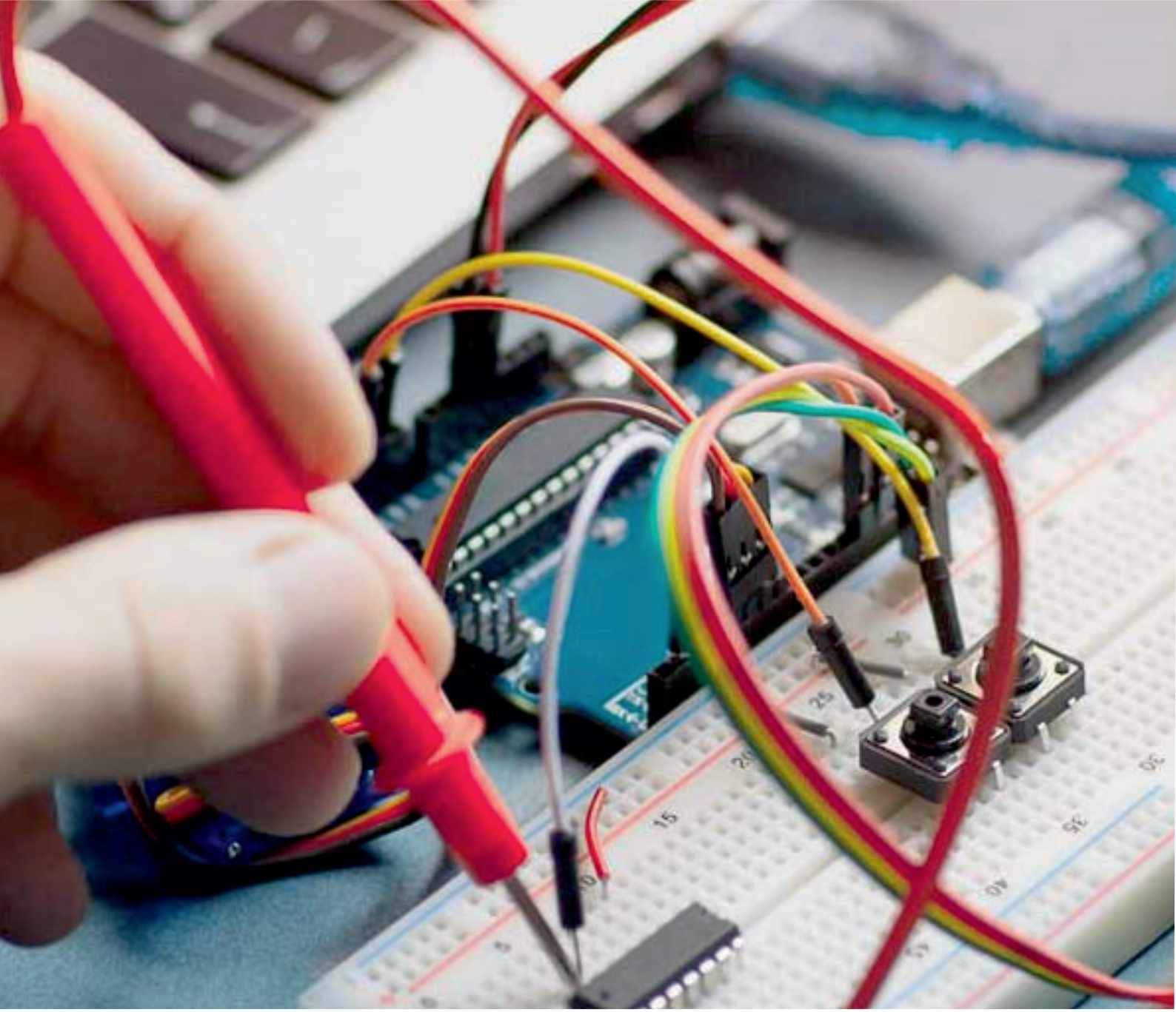

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