

Design Paper on Petrol Pump Theft Security System

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Abstract— Automobiles have become an integral part of modern life. The increase in the number of vehicles has led to the rise in the consumption of petroleum fuel and the cheating happening in this business. There are numerous ways in which the consumer can be cheated, and this kind of fraud can harm the consumer as well as the company's reputation. So, there is a need for a system that can reduce such type of malpractices and give the right to the customers to check if they are being cheated or not. The system in which not the operator at dispenser nor the manager of respective petrol pump but the customer has the power to check whether he or she has been wronged or not. The CCTV camera surveillance provides a way to monitor any place 24x7 but it requires manpower to scan the footages captured by the camera, and there is a possibility that such malpractices can remain uncaught in this type of monitoring. So, there is a need for a smarter system at such places which aims at identifying all such malpractices and which do not depend on manpower for their identification. This design paper gives the design of a security system at a petrol pump which can overcome almost all malpractices that can happen in its surroundings. The system identifies the malpractice and notifies the consumer and the manager by itself without depending on manpower at the petrol pump.

Keywords—Camera, Dispenser, Raspberry Pi, Bluetooth Smart, IR Sensor

I. INTRODUCTION

The traditional security and monitoring system installed at the petrol pumps involves the use of CCTV cameras and a separate room to keep an eye on all the recording done on those cameras. Usually, a man is responsible for scanning all such recordings, and he also has the responsibility to identify the malpractice, if any, happening at the petrol pump. But it is quite natural that a man can miss out certain malpractices that actually happened. It does not seem like a practical approach scanning each and every part of a 24-hour recording, by a single man, and if multiple cameras are involved, then it is more likely to miss out things which are important. The consumer or the company will never get to know that they were being cheated upon. In order to overcome this problem, the paper gives the design of a system which involves the use of camera interfaced with Raspberry Pi that will keep a track of and sense any suspicious activities that might occur and can raise an alarm if any malpractice is committed.

II. PROTOTYPE DIAGRAM



Fig 1: Petrol Pump Monitoring System Prototype

III. PROPOSED SYSTEM

The proposed system is a security system built in using CCTV cameras, Raspberry Pi, Bluetooth smart, and IR sensor. The Raspberry Pi is a small credit card sized chip computer used for programming and in many other applications. It has camera interface to which the camera can be easily connected. It has 900MHz quad-core ARM Cortex-A7 CPU and 1GB memory^{[1][2]}.

Bluetooth is wireless technology standard for exchanging data. Bluetooth uses more power and requires reconnecting the previously connected hosts again, but Bluetooth Smart i.e. Bluetooth 4.0 is more intelligent than standard Bluetooth. It manages the connection well, and at the same time, it consumes less power.

IR sensor measures the IR light radiated by any object. All objects with a temperature above absolute zero radiate some light waves but it is not in the visible range of human eyes as the rays are at infrared wavelengths, and therefore, only IR sensor is able to detect them.

IV. COMPONENTS OF SYSTEM

- **Raspberry Pi B+ model**
The Raspberry Pi is a small chip with ARM processor suitable for many outdoor applications. Raspberry Pi B+ model has introduced many improved features as compared to old Raspberry Pi B model. It has more USB ports (4), the GPIO pins have also been increased to 40, and yet it consumes lesser power of about 0.5 w to 1 w. The entire structure of the system would be built on Raspberry Pi^[3].
- **CCTV Camera**
Closed Circuit Television Camera is the cameras used mainly for surveillance and security purpose. It is similar to other cameras, but the signals captured by the camera are not distributed, they are given to some authenticated people only. These cameras would be used to monitor the premises of the petrol pump.
- **Bluetooth Smart**
Bluetooth is a wireless technology used in personal area network for short range data transition. Bluetooth Smart is a new version of Bluetooth i.e. Bluetooth 4.0. It is an inexpensive and developer friendly technology used in many gadgets nowadays. It'll be used to send signal from the nozzle of the dispenser to the camera^{[4][5]}.
- **IR sensor**
Every object radiates IR waves, but they are not visible because the waves have wavelengths between 0.75 and 1000 μ m. The IR sensor detects them easily. When a human or any other thing passes through the range of PIR sensor there is a change in the IR radiation and this change in radiation is converted into the change in voltage and PIR sensor triggers the motion. These sensors would be used to detect if the vehicle has moved past the dispenser or not^[6].

V. STRUCTURE OF PROPOSED SYSTEM

The system comprises of three cameras which cover the major part of the detection of malpractice. The very first

camera records whether the nozzle has been pressed correctly by the operator or not to fill the petrol in the customer's vehicle's tank. The second camera focuses on the reading of the dispenser itself to show all the readings to the customer and the price he's paying for it. Therefore, he would know if he's being cheated upon or not. Even after all this, if the customer still doesn't pay attention to the readings or the screen, the third camera would focus on the number plate of the respective vehicle.

The images will be transferred to the Raspberry Pi, and it will be checked whether any misconduct has been done or not with their help. In case, if any misconduct has happened, an alarm would be raised, and the customer would be notified of the same^{[7][8]}.



Fig 2: View of the Screen Setup at Petrol Pump

The output of these three cameras would be shown on the output screen set up at the petrol pump. This screen will be divided into four parts to show all the three outputs at the same time. The fourth, so far the unused part, can be used to display the advertisements by the company. If any malpractice is caught by the system, the consumer will be notified on the fourth part itself so that the working of the other three areas is not disrupted. At the same time, the manager of that particular petrol pump and the admin will also be notified to cross check all the aspects of the situation.

VI. WORKING OF THE SYSTEM

There are three modules in the system,

1. Sensing the vehicle and resetting the nozzle
2. Scanning the number plate of the vehicle.
3. Checking if any misconduct has happened

1. Sensing the vehicle

As soon as the vehicle comes in front of the dispenser, the vehicle will automatically be sensed by the system. This will help in resetting the nozzle at the correct time. The IR sensor plays a vital role in sensing the vehicle

in front of the dispenser. The sensed data will directly be sent to the Raspberry Pi by the Bluetooth smart wirelessly. This received data will be processed further. Once the vehicle has been detected to be present in front of the dispenser, the nozzle will be reset to zero. Hence, the resetting does not depend on the operator at the dispenser.

2. Scanning the number plate of vehicle

The number plate of the vehicle will be scanned for future reference in case any malpractice has been caught. The consumer will be notified on the basis of that only.

3. Checking if misconduct has happened

Images captured by the camera 1 and camera 2 are used to check whether the misconduct has been done or not. Admin, the manager at the petrol pump and customer, are notified in such cases^{[9] [10]}. The flow of the system operation is as follows,

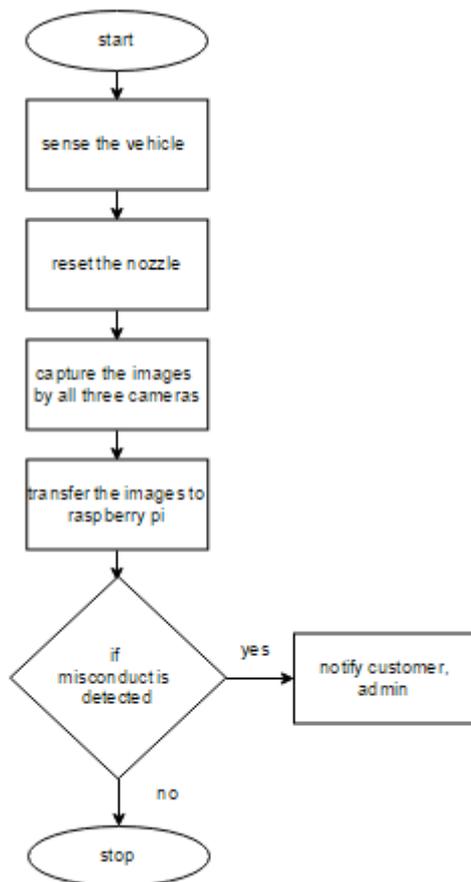


Fig. 3: Flow of the System Operation.

VII. EXPECTED RESULTS

- The images of petrol filling, vehicle number plate, fuel dispenser reading should appear on the screen
- Screen must be divided into four parts to display all images simultaneously.

- Images should be processed properly and the algorithm must be able to detect any misconduct.
- Alarm should be raised to warn the customer and the manager of the respective petrol pump.
- An email should be sent to the admin to notify him of frauds.
- The images of current misconduct should be saved for future reference.

VIII. LIMITATIONS

- The time taken by the algorithm should be short enough so that even if the customer requests petrol for 100 rupees even then the detection process finishes off within the time limit.
- Vehicle number can be detected by RFID but every vehicle specifically in our country does not have that. Therefore, we'll have to make use of image processing techniques in order to obtain the characters on the number plate.

SUMMARY

This design paper gives the design of a security and monitoring system at a petrol pump which can detect any malpractices happening on the petrol pump without much involvement of manpower. This system will ensure the security of the consumer, even if the man scanning the camera recording is not present over there. The system aims to benefit both the consumer and the company.

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