

## AUTOMATIC BOTTLE FILLING AND FIRE DETECTION SYSTEM USING RASPBERRY PI

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**Abstract---** In General, Three major points are to be considered in any industry is “cost to performance ratio of the equipment, safety & security”. We are replacing high-cost equipment (PLC’s) used in industry with Raspberry Pi which is cost-effective and also provide the same efficiency of equipment used in industries. There is a lot of property loss in the industry due to improper identification of fire when fire accident occurs.

The proposed system is to design an automatic bottle filling Station at a very efficient and reasonable installation cost & To Detect the Fire earlier before accidents and by increasing the safety in industries by using fire Object detection with the help of pi camera.

**Index terms:** PLC (Programmable logic controller), Raspberry Pi, Python, IoT, LCD, Pi Camera, Haar cascade GUI Trainer.

### I. INTRODUCITON

Generally nowadays in every industries PLC’s are used to automate the process .in order to use PLC’s the installation cost is pretty much high, and there may be requirement of the PLC’s Maintainer along with the Licensed software to operate the PLC. So the use of PLC’s is limited to the large scale industries only. If we want to automate the process in small scale industries like the rural and urban area people, they are not able to afford for the PLC’s. Here the best alternative ,open source Mini controller comes into picture that is the Raspberry Pi .with the help of this Raspberry Pi controller here we are implemented the automatic bottle filling & fire detection system with Raspberry Pi as the Main controller and with the help of IR sensor, DC Motor ,pump as actuators ,Four channel 5v Relay module to turn on the pump, L293d for to drive motor, and LCD display for to give visual information to the user .so these all are used for to automate the bottle filling. And for the fire detection we are used Raspberry Pi along with Pi camera.so, ultimately this paper focused on to design and implementation of the automatic bottle filling and Fire detection With Raspberry Pi.

This Paper is Organized as follows Section II will gives you the details of the components used to prepare this project, Section III deals with the Block diagram of the project work and the relation between different sensors and actuators, Section IV gives you the design and implementation of the automatic bottle filling and fire detection there you will getting know about the working method, Section V deals with the outcome of the project And finally Section VI gives the Conclusion and Future Scope & some of the references of this project.

### II.HARDWARE USED

Here we are used the following hardware used in order to implement they are Raspberry Pi 3 model B, IR sensor, four channel 5v relay module, 12v pump (immersible pump), 100 Rpm Dc motor, SMPS (switched mode power supply), 16X2 LCD Display, LM317 (+ve voltage regulator), L293D Motor Driver, and Pi Camera.

Raspberry Pi is the heart of the project it has forty pins which contains GPIO (general purpose input output) pins, vcc, Gnd etc. Pi 3 model B has 4 USB (universal serial bus) 2.0 ports, one LAN (Local area network) port for network connectivity, it has a powerful Broadcom processor chip. Pi3 has comes with inbuilt Wi-Fi connectivity, Bluetooth connectivity and it has the support of the Pi camera, LCD (liquid crystal display) support. IR sensor contains a IR transmitter which will transmits IR rays of (700nm-1mm), if the obstacle opposes to the IR rays then the rays are reflected back and these are received by the photo diode on the sensor, by this process IR sensor will detects the object. SMPS (switched mode power supply) contains the converter circuit which will convert the 50Hz 230v AC into a stable DC voltage here we are used 230V AC by 12VDC SMPS. L293D board is used to drive motor safely. Relay is used to activate the Pump for liquid filling it is operating voltage is of range 3-12v DC, which is immersible into the water.

### III.BLOCK DIAGRAM& CIRCUIT DIAGRAM

Raspberry Pi 3 model B has Taken input from the from the sensor that is IR sensor output which is input to the pi will be goes to low when there is a presence of the bottle & goes high when there is no object in front of the IR sensor .once the IR output goes low that is bottle is present so now the bottle has to stop at the filling point and start filling liquid, so in order to stop the motor we are not connected motor directly to the

Raspberry pi we should isolate the Pi from the motor Heavy starting currents with the L293D Motor driver. Which could be very useful to control the motor? The 12V pump is to be activated with Relay which is connected to the Raspberry pi.

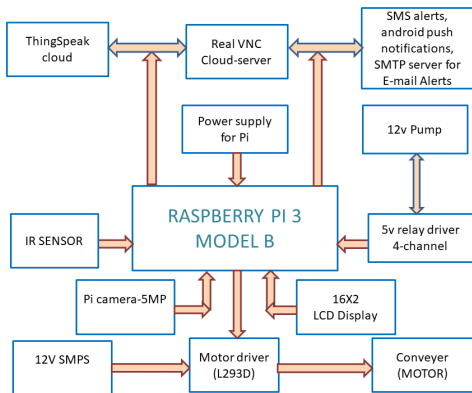


Fig.1.Block Diagram

LCD display will be connected to give the visual display information to the user at the station itself. Power supply of 5v, 2amp that is 10watt adapter is required in order to turn on the Raspberry Pi. Pi camera will be inserted in the camera port which is given with the Raspberry Pi 3 model B board. The details circuit diagram is given below.

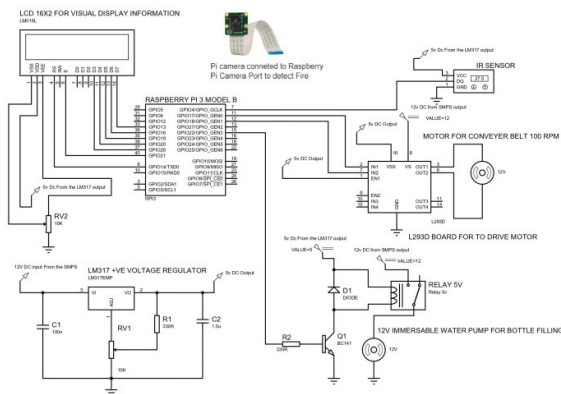


Fig.2.Circuit Diagram (designed in proteus 8.12 software)

**IV.DESIGN FLOW AND METHODOLOGY**

we are developed the entire software code is in python only, here the IR sensor will plays a key role in the bottle filling. When the Program execution begins Pi will continuously monitoring its IR sensor which is connected to the one of the GPIO pin of the Pi. If IR sensor detects the object-Bottle then pump will turned on with the help of the Relay module which is

connected to the Raspberry pi and liquid is filled to sufficient level and the bottle is move forward, Now one count with in the program is incremented and this data is sent to the Thingspeak cloud and plotting of data at the channel in Thingspeak is done. And if sensor not detects any object-bottle, conveyer kept on until next object is detected .the LCD display is used to give the visual information to the user. Once the process is starts it is initialized and displays “Process is initialized” and “Automatic bottle filling system”. And it will displays “Place a bottle” when there is no object with in the conveyer, displays “Bottle is filled” when the bottle is filled.

Pi camera is used to monitor the station if Fire is detected Pi will send alerts to the user and further actions has to be taken. In order to detect the fire we are used a Haar cascade Gui trainer software where we are given some images of fire to the gui trainer as positive images and the some of the background images as negative images for the Haar cascade GUI trainer software .the positive images contains the object which is used to detect with the help of the Pi camera. After starting the train a model after processing the GUI trainer will generates an .xml file which could be used to give as an input the fire detection python program.so with this .xml file the fire is detected.So once the fire is detected the alerts will be sent to the user’s as SMS alert,E-mail(Electronic mail) alert and Push notifications to the Push Bullet Application of the registered users android mobile.

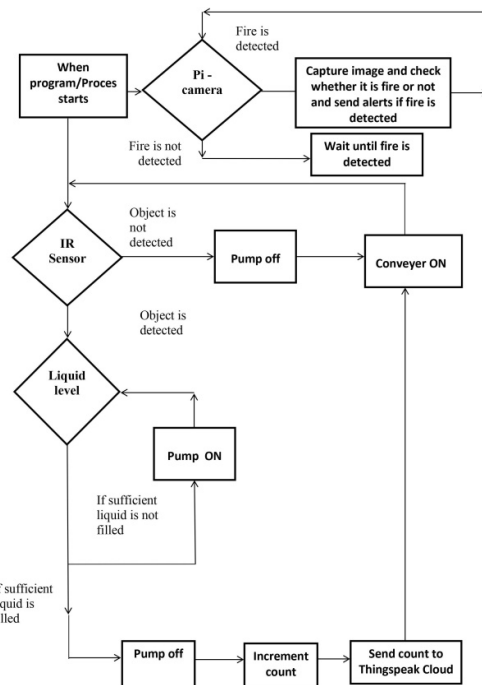


Fig.3.Design Flow

**Project Development Steps:**

Initially we are Setup the Raspberry Pi with stable Rasbian Os From the official website. And flashed the

OS (operating system) with balena etcher software(open source) and then getting Know about How to connect the Raspberry Pi to the Laptop with the help of Advance IP Scanner, Putty, VNC Viewer(With Realvnc Cloud Account enabled).after that we are installed Python 3 on Raspberry pi 3 Model B ,And then Installed some of Essential Modules,Packages,Libraries which includes “pip” latest version, “twilio” for SMS (short message service) alerts, “smtplib” for email alerts, “Pushbullet” for Android push alerts, “Adafruit\_CharLCD” for Visual Display Information with 16X2 LCD Display, “Open CV” for object detection. And finally Enabled the Picamera from the GUI (graphical user interface) of pi the camera enable option is found on the path “pi configuration-interfacing-camera” in order to detect the fire. And finally, Software and Hardware Co-Designis developed.

## V.RESULTS

The entire system is designed on the two sub section that is hardware and software setup, initially we are getting know about individual working of the IR sensor, 100 Rpm DC motor, 12v pump, four channel 5v relay, LM317 and then we are developed a python code for individual hardware and finally we are club those software code along with hardware in order to get the final result that is automatic bottle filling and fire detection. After successful implementation of the working of the hardware with software we are design the basic set up for this project. So, hence we are successfully designed and implemented the Automatic bottle filling & fire detection system.

We are successfully filled bottle automatically and the data that is no of bottle produced after process starts is set to the Thingspeak could for the purpose of the further forecasting of the production. With the help of the Thingspeak we could have the data as a .CSV file which contains the data log of the data sent from the Pi with Time stamps so that we have a provision of increase or decrease the productivity. And we are detected the fire object with the help of the Pi camera detected fire using object detection with Open CV (open source computer vision) library with python programming and successfully sent the alerts once the fire is detected. The following are the some of the outcomes of this project.

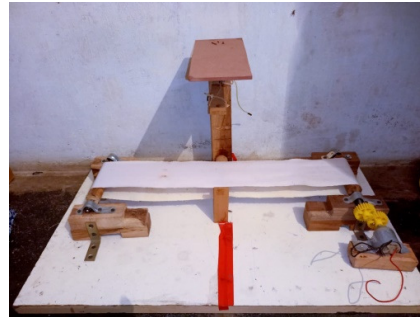


Fig.4.1. Automatic Bottle Filling System Basic Setup Front View



Fig.4.2. Automatic Bottle Filling System Basic Setup left side View



Fig.4.3. Automatic Bottle Filling System Basic Setup Right Side View

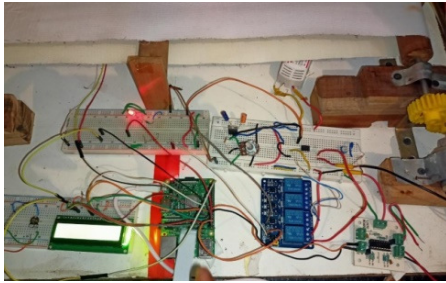


Fig.4.4.Hardware setup



Fig.4.5.Bottle is filling with the help of pump when IR sensor detects it

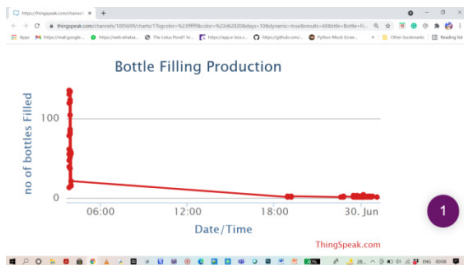


Fig.4.6.No of bottles filled data sent to Thingspeak cloud

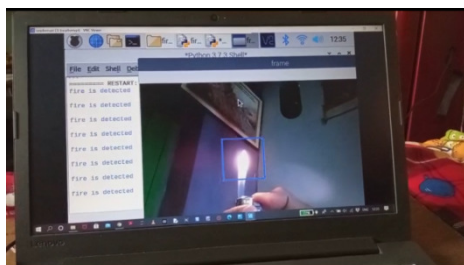


Fig.4.7.Fire is detected and prompting fire is detected on the shell

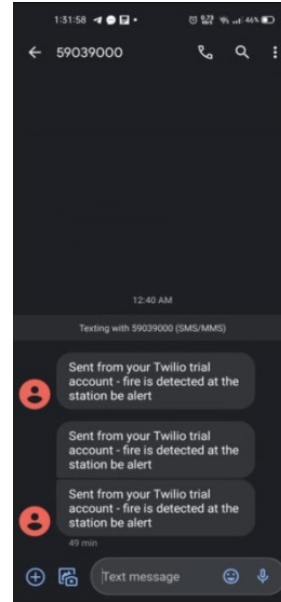


Fig.4.8.Sms alert is sent to the registered user mobile number once the fire is detected

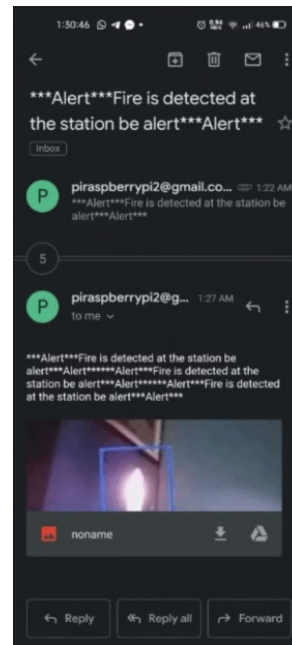


Fig.4.9.Email alert along with image captures sent to the user mail if the fire is detected

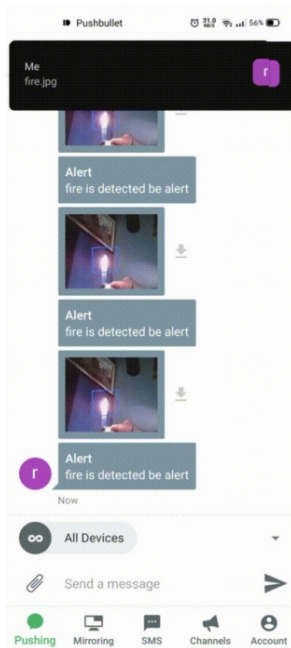


Fig.4.10.Android Push Notifications is sent to user’s push bullet Android Application

**VI.CONCLUSION**

The proposed work is focused on two things 1) to create a system that can helps to urban area people who wants to invest in small and medium enterprises. Those enterprises, therefore, require an automatic and affordable device that can fill water into bottles.2)To detect the fire in industries to avoid the property loss in advance with the help of the Pi camera using object detection with Open cv.

In future, the proposed work can be extended to implement the automatic customized bottle (Bottle size) filling, Automatic Capping for bottle and automatic labelling for bottle so that the entire Product as a bottle is done. And if the fire is detected and if it is real then automatic extinguishing has to be done.

**REFERENCES**

[1] Industrial Automation using IoT, International Research Journal of Engineering and Technology (IRJET), Volume: 04, Issue: 06 | June-2017, PP 205-208.

[2] IOT based Industrial Automation, International Research Journal of Engineering and Technology (IRJET), Volume: 05, Issue: 03 | Mar-2018,PP 1895-1899

[3] Industrial Automation using IoT with Raspberry Pi, International Journal of Computer Applications (0975 – 8887) Volume 168 – No.1, June 2017,PP.44-48

[4] IOT Based Industrial Automation, IOSR

Journal of Computer Engineering (IOSR-JCE), e-ISSN: 2278-0661,p-ISSN: 2278-8727 ,PP 36-40, www.iosrjournals.org

[5] S. A. I. Quadri and P. Sathish, “IoT based home automation and surveillance system,” 2017 International Conference on Intelligent Computing and Control Systems (ICICCS), PP.861-866, June 2017.

[6] Industrial Automation using Internet of Things (IOT), International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 5 Issue 2, February 2016,pp 266-269

[7] Fire detection system using raspberry pi,International Conference on Information Science and Communication Technology (ICISCT),2019, ISBN:978-1-7281-0447-8,https://ieeexplore.ieee.org/document/8777414

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