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AUTOMATIC BOTTLE FILLING AND FIRE DETECTION SYSTEM USING RASPBERRY PI

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Abstract--- In order to improve the FBMC/OQAM system, this paper suggests a new preamble design and an associated channel estimation method. The results of FBMC are fed into STBC-based Massive MIMO systems to lower error rates and power-related problems. The frame's extensive preamble structure was constructed using the Zadoff chu sequence. Results show that the suggested approach outperforms the conventional preamble structure with respect to spectrum efficiency and reduced PAPR values. In addition to being simple to execute, the suggested technique achieves high BER performance in terms of signal-to-noise ratio and mean squared error for the timing offset and frequency offset that are connected with it. Thus, it is immediately usable by cutting-edge mobile networks such as 5G.

Keywords: PLC, Raspberry Pi, Python, Internet of Things, LCD, Pi camera, and Haar cascade GUI trainer.

INTRODUCITON

At the present time, PLCs are being used extensively across all sectors to automate operations.It may be expensive to install and operate power logic controllers (PLCs), and you may need to hire a PLC maintenance company or purchase licenced software on occasion. Consequently, PLCs are used only by extremely large corporations. The cash to spend in the PLCs needed for process automation is out of reach for many smaller businesses, regardless of their location - rural or urban. The open-source Raspberry Pi, the top choice, serves as the little controller in this setup.Automatic bottle filling and fire detection are both made possible by this system's central controller, a Raspberry Pi. Included in its components are an infrared sensor, a DC motor, a pump, an L293D for motor control, a four-channel 5v relay module for pump operation, and an LCD display for user-facing visual information.For that reason, we utilise each and every one of them to make the process of filling the bottles automatic. Using a Raspberry Pi and a Pi camera, the system can detect fires.The purpose of this study was to record the steps necessary to construct a system that can fill bottles autonomously and detect fires using Raspberry Pi.
Here is the outline of the document: In Part II, we will talk about preparing the project. Section III thereafter displays the project's block diagram along with the interconnections of the various sensors and actuators. The method of operation of the automated bottle filling and fire detection system is detailed in Section IV. In Section V, we go over the project's outcomes. Part VI contains the project's conclusion, references, and future scope.

The tools used for this rollout will be detailed in Section II. A Pi camera, an infrared sensor, a four-channel 5v relay module, an immersion pump, a 16x2 LCD display, a switched-mode power supply, an LM317 (positive voltage regulator), and an L293D motor driver were all part of the package. The Raspberry Pi serves as the system's central processing unit. Out of its forty pins, a few common signals are included, such as GPIO (general purpose input/output) pins, vcc, and Gnd.The B model of the Raspberry Pi 3 is equipped with a powerful Broadcom CPU chip, four USB 2.0 ports, and one LAN connector.You may use the Pi camera with the Pi3 since it has built-in Wi-Fi and Bluetooth. Part of the package is an LCD, or liquid crystal display.The photo diode on the infrared sensor receives the reflected infrared (IR) rays from an obstacle, which have a wavelength ranging from 700 to 800 nanometers, and up to 1 millimetre. The infrared sensor may then identify the object.Our 12VDC SMPS uses a 50Hz converter circuit to transform 230V AC into a stable DC voltage.Running a motor via an L293D board is a safe bet. For liquid filling, you may use the submersible relay, which can function on a DC voltage range of 3 to 12 volts.

BLOCK DIAGRAM& CIRCUIT DIAGRAM

Raspberry Pi 3 model B takes its input via an infrared sensor, which means that when the bottle is in the way, the signal goes low and when nothing is in its way, it goes high.Since we aren't connecting the motor directly to the Raspberry Pi, we need to use the L293D Motor driver to isolate the Pi from the motor's heavy starting currents. Once the IR output goes low, it means the bottle is present, and we can proceed to fill it with liquid. To regulate the engine, which one may be the most practical? The Raspberry Pi must be linked to the relay in order to activate the 12V pump.

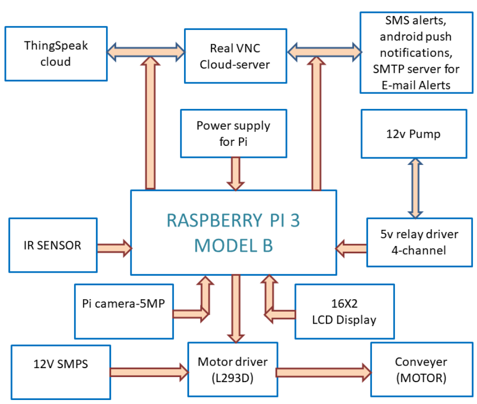

Fig.1.Block Diagram

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.

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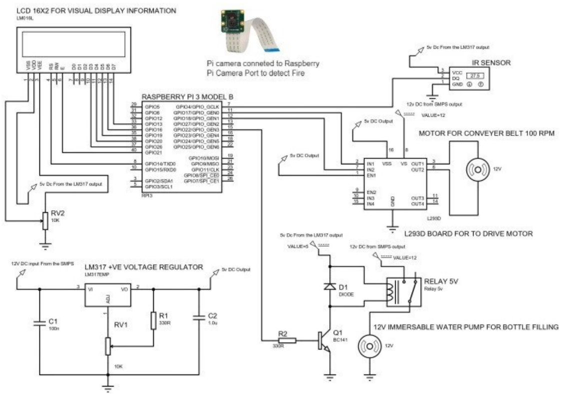

Fig.2.Circuit Diagram (designed in proteus 8.12 software)

DESIGN FLOW AND METHODOLOGY

Our company has grown Python is the only language used for the software code. An important component of the bottle filling process is the infrared sensor. As soon as the programme starts running, the Pi will keep an eye on its infrared sensor, which is linked to one of its GPIO pins. Once the infrared sensor identifies the bottle, the pump is activated through the Raspberry Pi's relay module, filling the bottle to the desired level. Then, the programme increments a count, sends this data to the Thingspeak cloud, and plots the data at the appropriate channel in Thingspeak. And if the sensor doesn't pick up any thing, the conveyer will keep going until it does.The user is provided with visual information via the LCD display. "Process is initialised" and "Automatic bottle filling system" are shown after the process is started, indicating that it has been initialised. Additionally, it will show "Place a bottle" in the absence of an item in the conveyer and "Bottle is filled" in its presence.

If a fire is detected, the Pi camera will transmit notifications to the user and additional steps will need to be done. We utilised a Haar cascade GUI trainer programme to train the programme to identify fires; the programme uses positive photographs of fires and negative images of backgrounds to teach its algorithms.The objects that can be detected with the Pi camera are included in the positive photographs. Once the train-a-model procedure is complete, the GUI trainer will produce an.xml file that can be used to feed into the fire detection Python programme.The.xml file has successfully detected the fire.Therefore, users will get alerts via Push notifications to the Push Bullet Application on registered users' Android mobiles, as well as SMS alerts and E-mail alerts.

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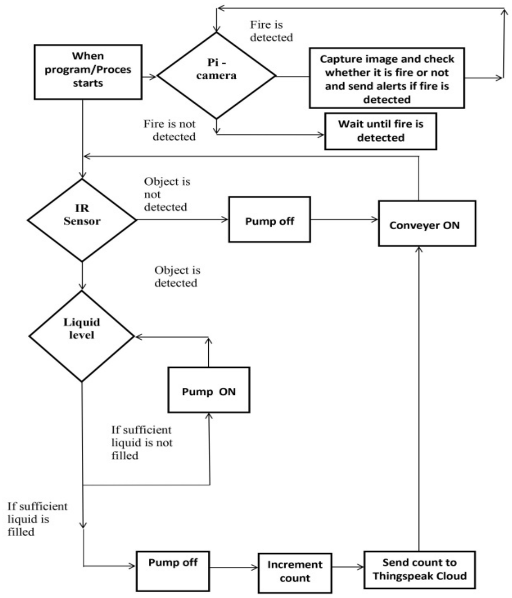


Fig.3.Design Flow

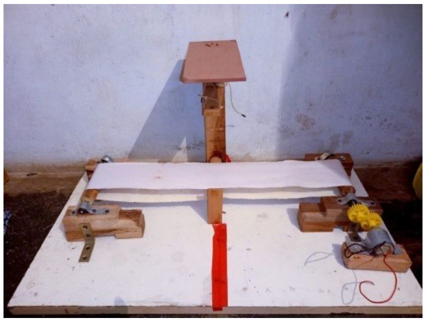
Project Development Steps:

Installing a stable version of Rasbian from the official website is the first step in setting up a Raspberry Pi. I learned how to install the operating system on the Raspberry Pi, how to connect it to a laptop using tools like Putty and Realvnc Cloud Account enabled VNC Viewer and Advance IP Scanner, and how to use the free and open-source Balena image-editing software.Following this, we installed Python 3 on the Raspberry Pi 3 B.I then proceeded to install several necessary modules, packages, and libraries, including the latest version of "pip," "twilio" for SMS alerts, "smtplib" for email alerts, "Pushbullet" for Android push alerts, "Adafruit_CharLCD" for 16x2 LCD display information, and "Open CV" for object detection. In the end, you may enable the Picamera for fire detection by navigating to the "pi configuration—interfacing—camera" section of the Raspberry Pi's GUI. Software and hardware co-design is the last topic.

III. OUTCOME

Separate procedures are used for configuring the software and hardware components of the system. An infrared sensor, LM317, 12v pump, four-channel 5v relay, and 100 Rpm DC motor are all described in detail in the first half of the article. Making python scripts for each piece of hardware is the next stage. Finally, we construct the system that can automatically fill bottles and detect fires by integrating the hardware and software. We will go on to laying the groundwork for this project after the software and hardware have been correctly installed. Thus, the fire alarm system and the automatic bottle filling system were both successful.
We have recorded the entire number of bottles manufactured in Thingspeak in order to forecast future production, and we have automated the process of filling bottles. We can get data in CSV format using Thingspeak. This file stores the data supplied by the Pi together with timestamps,

allowing for output to be fine-tuned. If the Pi camera detected fire, the alarms would go off quickly thanks to Python programming and the open-source computer vision package OpenCV. These are only a few of the many results that our hard work yielded.



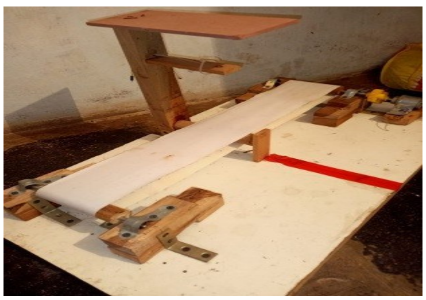


Fig.4.1.Automatic Bottle Filling System Basic Setup Front View

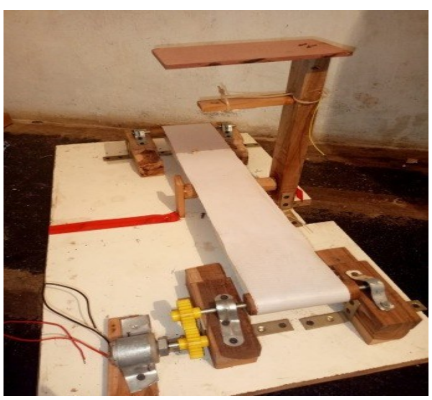


Fig.4.2.Automatic Bottle Filling System Basic Setup left side View

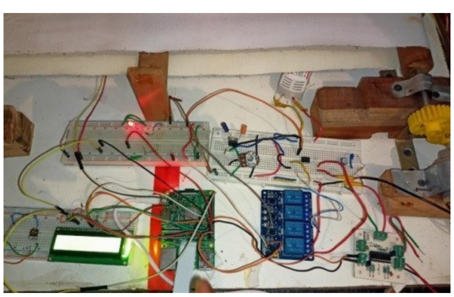


Fig.4.3.Automatic Bottle Filling System Basic Setup Right Side View

Fig.4.4.Hardware setup

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

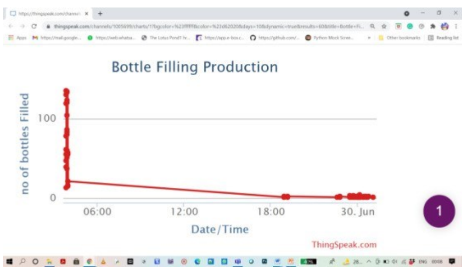


Fig.4.6.No of bottles filled data sent to Thingspeak cloud

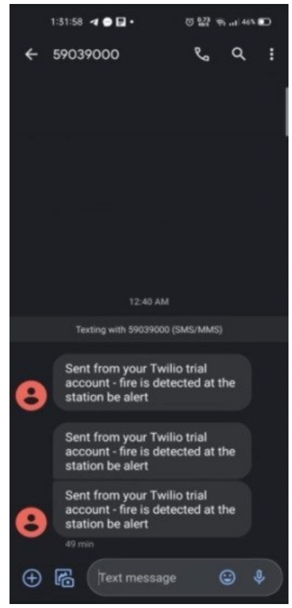


fig.4.9.Email alert along with image captureis sent to the user mail if the fire is deteced

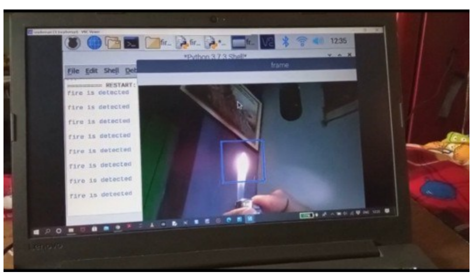


Fig.4.7.Fire is detected and prompting fire is detected on the shell

CONCLUSION:

The proposed research has two key aspects. the first is to figure out how to get people living in big cities to put their money into small and medium-sized companies. This is why these types of enterprises need an affordable, fully-automated water bottle filling machine.Early detection of industrial fires using the Pi camera in conjunction with object identification using OpenCV may significantly reduce property damage.

Extending the present work to include automated filling of tailored bottles (according to bottle size), automatic capping of bottles, and automatic labelling of bottles will complete the product as a bottle. In addition, once a fire is spotted and verified as real, the automated extinguishing system must be engaged.

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