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Development of Security and Surveillance System for Oil Production Platform.

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ABSTRACT
Offshore equipment and facilities, with the platform in focus, are some of the most capital intensive asset costing millions and/or billions of dollars to setup. The use of Ineffective security measures on offshore platforms can result in vulnerability of huge assets, internal and external threat oil production theft as regards to pipe line vandalism, gas leakage, rise in temperature, fire outbreak, etc. Since other traditional means of security such as watch by a human-being' have been found to be ineffective as the performance of the personnel on guard depends on his motivation, fatigue and concentration and skill level. This work aims at developing an automated electronic system tailored to effectively provide security and surveillance for equipment and facilities on offshore platforms against these challenges. The system performs the task of security and surveillance through the combination of integrated chips, logically linked to sensors for motion, temperature, flame, gas as well as the evaluation of surveillance camera to form the set of artificial intelligence. The system performance, during functionality test was satisfactory with an average start-up initialization time of about 2minutes and an average lag-time of not more than 15 seconds upon detection of flames and/or fire, motion of an intruder.

Keywords: *Motion, flame, smoke, temperature sensor and a Pi camera etc.*

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I. INTRODUCTION

Security in several industrial and business environments is a critical process in security assessment. It must be exercised 24-7. With the advancements in wireless IOT technology, it has become much easier to design, develop, and deploy a cost. Sood P. et al, 2019 provided a survey of different Methods in Border Security and Surveillance, The aim was to compare different researches in border security. Arfaoui et al, 2017 developed a model that estimates the crossing time of the monitored area taking into account the characteristics of the area and the behavior of the intruders crossing this area. Then they proposed a deployment method based on the intruders crossing paths that optimize the number of deployed sensors while ensuring an early and high detection level of the intruders. Al Abkal et al 2020 investigated the use of drones, in border security and their ability to enhance existing security measures in Kuwait's ports and borders and also along borders of the United States. The study contributed to practice by introducing the use of UAVs to enhance port security, especially for monitoring and surveillance purposes.

Suwaid A. A, et al(2020) carried out an investigation into the use of unmanned aerial vehicles (UAVs), also known as drones, in border security and their ability to enhance existing security measures in Kuwait's ports and borders and also along the borders of the United States. He approached the study by finding out how UAVs can be effectively utilised to enhance port security. Both primary and secondary data were collected using qualitative and quantitative methods. Primary data was collected using an online survey issued to 66 port-related respondents and from five semi-structure telephone interviews, with a subset of the survey respondents. The primary data analysis revealed that port officials were aware that UAV technologies can bring a significant improvement to their security. However, there were risks associated with the implementation of such system, especially concerning the threat of terrorist organisations and cyber security. Therefore, it was concluded that, for the successful implementation of this technology in port security, a proper framework needed to be set in place.

Offshore equipment and facilities, with the platform in focus, are some of the most capital intensive and strategically placed asset that requires million and/or billions of dollars to setup. It is therefore very necessary to put in place a robust security and surveillance system to ultimately protect these huge capital-intensive investments, not only due to their vital economic importance to our country, Nigeria, but also as a result of their high rate of vulnerability to both internal and external threat which could result to a potential

nightmare to lives and property on board, if it's not well addressed. S. Boukhalfa et al(2021) proposed a border surveillance system. This surveillance and security system was used to detect and track intruders trespassing into the monitoring area along a border which triggered alerts in case of a threat. The system was based on the classification of the human gestures drawn from videos envoy by drones equipped with cameras and sensors in real-time. All accomplished experimentation and acquired results showed that the benefit diverted from the use of the system, and therefore, it enabled the soldiers to watch the borders at each and every moment effectively and at low cost. Laura et al 2019 proposed a multilayer hybrid architecture based on cameras, scalar sensors, radars, and UAVs to design a border surveillance system. Bhadwal et al 2019 proposed a smart border surveillance system that can provide round the clock video surveillance at the places where human deployment is not possible. Amaziah 2011, carefully illustrated how the principal Environmental loads (wind and wave), current forces, loads from ice and loads from earth-quake for (earth-quake prone zones) are deployed to archive the design and construction of offshore concrete gravity platforms. Two design methods (Analysis and Design of Shell structures) and the Tangent Modulus Methods of design of Offshore Concrete Gravity platforms are discussed. Finally, foundation design of Offshore Concrete Gravity Platforms, the advantages of concrete offshore structures over steel platform were discussed. Monitoring of unfamiliar objects within and outside the platform requires an al round-the-clock (24/7) observation through the provision of security forces, in the event of any physical intrusion, to quickly respond to any threat within a safe distance and also the setting up of a surveillance system to detect and track real time security concerns with a much more wider and effective area coverage, designed to operate in harsh (sea waves, fog, etc) and unprotected (extreme heat, cold precipitation, etc) environment all round the clock. As a result of their enormous economic importance and the difficulties encounter while attempting to secure large water areas, Oil and gas rigs constitute a preferred target for terrorist and criminal activity. Consequently, offshore rigs (platform) require maximum security and surveillance, due to their volatile and demanding environments to protect them from threats and ensuring uninterrupted safe operation. Security and surveillance in oil production platform system is a system which matches the present day need of man to his socio-economic environment. Providing a real time process control at home, office, industry and the state depending on the scope of usage while at a sure time making a real time engineering control of hazard that are prevalent in the oil and gas facility and environs. With the design model, the system can be implemented on industrial facility, oil and gas platform, as well as residential building and environs. Area of application determines the features to be activated and level of calibration required. Tahmasib F.et al 2020, proposed model with a subsystem of smart video surveillance in the oil and gas sector, consisting of such subsystems as a smart field, smart grid, smart maintenance, smart transportation, smart security, etc. Conceptual tasks were considered in the model and recommendations for their solution were given. The system addressed the following fundamental issues, viz: Security, Surveillance and Safety.

II. METHODOLOGY

The methodology presented here is intended to integrate both technologies adapted for the Nigeria environment. Pipeline security and safety system is an integration of automation system and internet of things. For proper architecture development, this section was analyzed from two large perspectives. viz, Automated Secured System (ASS) and internet of things (IoT), ASS shall be presented first, thereafter IOT. The Analysis begins with a detail engineering design on power pack, transceiver, and amplifier units and the various sensors that make up the ASS. Because construction was made to strengthen the design work model, the module used in the design work was also analyzed. On the networking aspect of this work, a detailed analysis on Wireless Sensor Network (WSN) and its IEEE 802.15.4 was done, which was used to achieve connectivity.
A block diagram of the security surveillance system is depicted below.

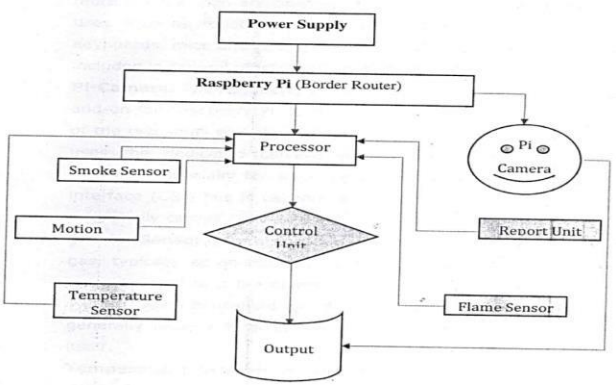

Fig 1: Block Diagram of the Pipe security System

A brief explanation of the above block is presented below

Raspberry Pie: The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated, selling outside its target market for uses such as robotics. It does not include peripherals (such as keyboards, mice and cases). However, some accessories have been included in several official and unofficial bundles.

Pi-Camera: The Raspberry Pi Camera Module is a custom designed add-on for Raspberry Pi. It attaches to Raspberry Pi by way of one of the two small sockets on the board upper surface. This interface uses the dedicated camera serial interface (CSI), which was designed especially for interfacing to cameras. The camera serial interface (CSI) bus is capable of extremely high data rates, and it exclusively carries pixel data.

Smoke Sensor/ Detector: A gas detector is a device that senses gas, typically as an indicator of fire. Commercial security devices issue a signal to a fire alarm control panel as part of a fire alarm system, while household gas detectors, also known as gas alarms, generally issue a local audible or visual alarm from the detector itself.

Temperature Sensor: A temperature sensor is a device that detects and measures hotness and coolness and converts it into an electrical signal.

Processor: The processor receives these multiple queries, process these data, send it to the control unit for further action.

Control Unit: Based on the processed data the control unit makes the final decision which becomes evident on the output line.

Output: A result produced by a computer that is internal to the system (from one program or process to another) or external to it (from a program or process to an output device) but internal to an output device (modem, monitor, printer, etc.

III. CONSTRUCTION PROCEDURE

Haven designed the circuit diagram and structure from first principle, using appropriate components and determining their corresponding values, the construction was embarked on. Basically, the construction is in two parts, viz; the electrical/electronics unit and the casing. The construction of both units was carefully plannedtaking into consideration time and utility of device.

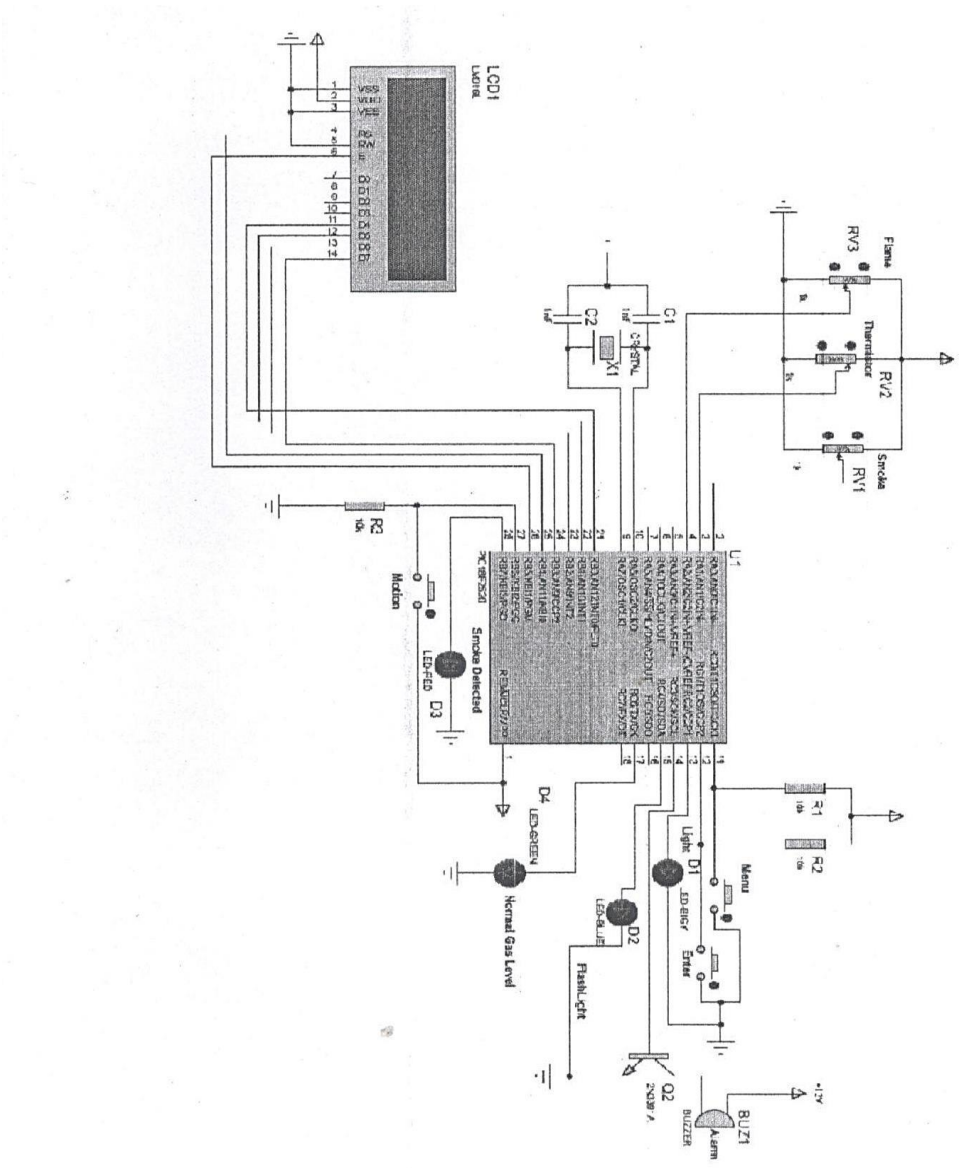

Fig2:Circuit diagram.

Tools And Equipment Used

The hand tools and equipment listed below were made use of throughout the construction of this project work to ensure that the desired results were achieved.

- Pliers and cutters
- Set of screw drivers
- Hand drilling machine
- Soldering iron
- Soldering iron stand
- Lead
- Lead sucker
- Breadboard
- Vero board
- Jumper wires
- Razor blade
- Cable stripper
- Brush etc.

The equipment/components used include:

- Breadboard
- Veroboard
- Buzzer
- LED
- LCD
- Resistors
- Capacitors
- Diodes
- Voltage regulators
- Transistors
- Cables
- PIC Microcontroller etc.

The procedure for the construction of the electronic unit of the security and surveillance system is outlined below**;**

Pre-Connection: The unit was first connected on a bread board to test the functionality of the unit and to effect any change if need be.

Marking Out: The various positions for the components are marked on the Vero board through the non-coppered side.

Component Placement: The components were placed on the marked positions on Vero board through the non-coppered side.

Joining Process: The actual joining of the resulting joints of the components was done using hot soldering iron and soldering lead. Excess lead splash were removed using de-soldering pump to prevent short circuit of the connection lines.

IV. TESTS AND RESULTS

During the design and construction phase of this Work, certain tests were carried out to ensure proper functioning. Details of these test and results are summarily outlined below:

Continuity Test: The test was carried out with a digital Multi-meter. In reading for the continuity, the meter is adjusted to the section designed to carry out continuity test, usually this section is made to buzz when the test is carried out. The buzzing sound indicates continuity or a line/circuit. A continuity test was carried out on all the wires, bus and connected circuits, to ascertain continuity.

Polarity Test: This was carried out to ensure that the wires and components were connected in the right way and in the right direction. For instance, the electrolytic capacitors has sides with stripes and this is designated the negative terminal while the unmarked area is the positive terminal. Also, the diodes used for rectification, illumination, infrared radiation etc were equally tested to ascertain its anode and cathode respectively. Furthermore, the IC polarity was tested before it was incorporated in the main construction.

Others: The circuit was powered and each voltage point was read, tested, and certified okay. The voltage from the transformer was read, after, bridge rectifier it was again read. The voltage regulator output was read to be sure the IC was functioning before connection to the main circuitry was made. Also, the I.Cs output used in the circuit was read.

Operation Test: To ascertain the functionality of the work, the circuit was connected to the main power supply and operated where there was a feedback, it was observed that all the units operated as required.

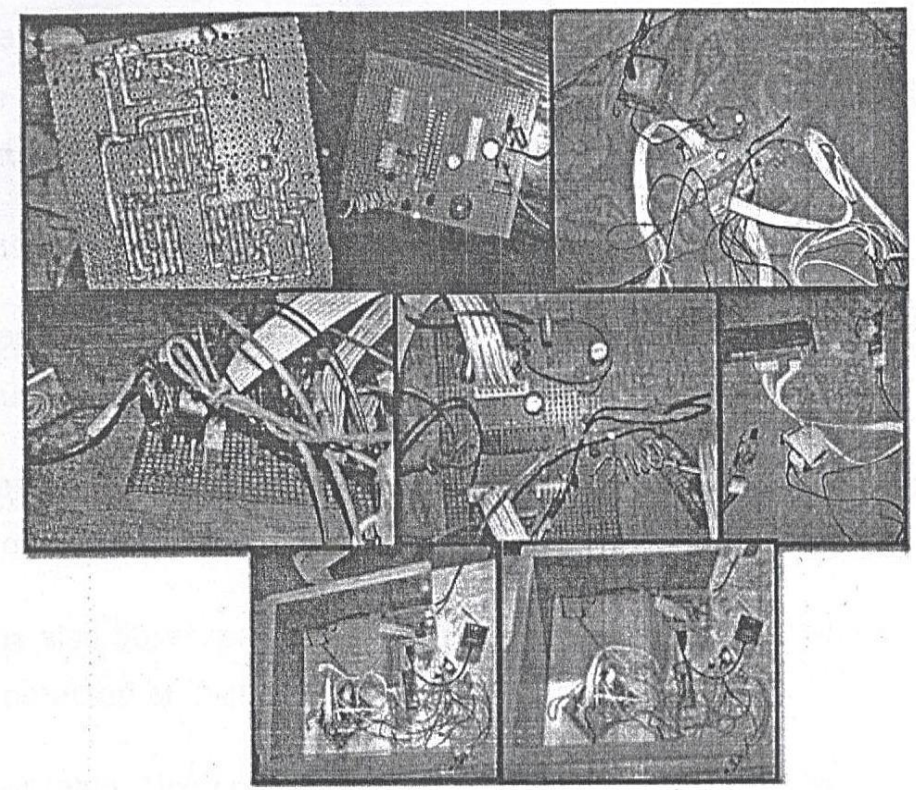

Fig3: The pictorial view below shows a complete soldering of this project

V. CONCLUSION.

The design and construction of this work, incorporated several components/sensors viz; Motion, flame, smoke and temperature sensor and a Pi camera for a real time view and the surveillance system was able to visualize the proposed section.

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