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Smart Drainage System Using Programmable Logic Controllers

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ABSTRACT:PLC (Programmable Logic Controller) is considered as the central or main controlling unit of any operations present in any application, process or industry with efficiency and productivity. This paper briefly explains the need for PLCs when compared to other controller logic such as RLC (Relay and Contactor Logic) and highlights the advantages of PLC which is used in our application. The PLC based system increases the operation process speed by using automation and reduced human intervention which increases the system efficiency and reliability. Also, PLC along with DCS (Distributed Control System) and SCADA (Supervisory Control and Data Acquisition), which are the new application specific tools used with PLC, helps to increase the accessibility, flexibility and ease of use in the process control system.

KEYWORDS: Drainage system, plc drainage, SCADA, dcs, controllable drainage system.

I.INTRODUCTION

Drainage is the natural or artificial removal of a surface's water and subsurface water from an area with excess of water. Water is one of the most important compounds ensuring life on Earth. But on roads the presence of water means mainly trouble. A main cause of road damage, and problems with the serviceability of road networks, is excess water filling the pores of road materials in the road and in the subgrade soils. Drainage pipes are used for the disposal and unfortunately sometimes there may be loss of human life while cleaning the blockages in the drainage pipes. To overcome this problem and to save human life we implement this automatic industrial drainage system. This proposed concept is to replace the manual work done in the drainage pipe cleaning by automated system. For solving real time problems, we have designed this project to use this in efficient way to control the disposal of wastages and with regular filtration of wastages, clearance of gaseous substance by means of absorbing and storing in a separate way where the toxic and non-toxic gases are treated separately and the disposal is monitored in a frequent manner. PLC is the major controlling unit and the drainage level is monitored by supervisory control and data acquisition technique. Automatic drainage water pump monitoring and control system consists of Solenoid valve, gas exhauster, level sensors. The gas sensor is a device that detects the presence of gases in the drainage pipe area. The toxic and non-toxic gases were separated, by using the gas exhauster. The level sensor get activated, to check the water level and the gas concentration created inside the pipe. When the pressure exceeds the certain limit the pressure valve opens. If the water level is high, the compressor operates with minimum pressure. This industrial drainage system is utilized in industries, hospitals, etc. The gas sensor is a device that detects the presence of gases in the drainage pipe area, often as a part of a safety system.

II. METHODOLOGY

This paper discusses the design of a control system for water level monitoring, which is completely based on the PLC system which consists of converters, transceivers and an electrical motor to control the water pump. The dashboard consists of LEDs connected to PLC output which is used to indicate the water level. This system works by measuring the water level present in the tank. If the water is less than the minimum level the sensor detects and converts it to logic 1 which is interrupted by PLC input. This is then displayed in the dashboard using the LED of minimum water level. When thewater reaches the maximum level, the sensor detects and converts it to logic 1 and it is sent to PLC. Another

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input of PLC is used to measure the proper working and speed of the motor used for the pump. A LED is used in the dashboard to indicate the proper functioning of the motor or if the motor has any fault. This paper helped us to interface wireless sensor nodes to PLC and how to control the actuator based on the signals from these sensors. The main disadvantage of this system is that the contactor used has reduced capacity for overloads and gets short circuited at full load operationsThey developed classical and robust PI controllers for PMDC motors. For Direct Current control of the system Siemens PLC is used and the system comprises two components, PLC based PI derived from PID controller which consists of both analog input and output module and the motor systemDuring simulation the parameters of the PI controller for PMDC motor uses feedback motor control based on Internal Model Control (IMC) which is simulated in MATLAB/Simulink simulator. The controller method is difficult to use to control nonlinear systems because there is a lot of measurement noise and the torque on the motor shaft which has a big impact on the stability and control performance.

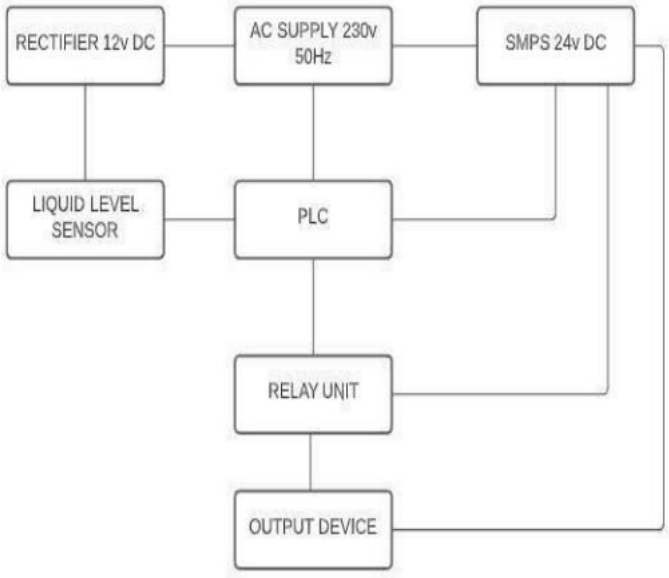

Fig 1. Water level control system

DC motors are widely used because of fast performance and wide range of speed regulations. This is achieved by using PLC which reduces the size of the control panel, proper operations in worst cases and very low energy consumption. The speed of DC motors is regulated in this study using a PID controller and the powerful tool MATLAB/Simulink. A shaft encoder is used to monitor and transfer the DC motor speed to the PLC, where the (Proportional Integral Derivative) PID controller generates the control signals to achieve the desired speed.

The analog signals are proportionally transmitted to the DC drive by the digital to analog module to maintain the required speed. The study's flaws include the fact that the temperature rise of the motor should be calculated using data such as load operation, motor efficiency, and thermal increasing coefficient to avoid DC motor operation at high temperatures, which causes velocity loss. This paper discusses the software structure and PLC hardware which are required to build the SCADA (Supervisory Control and Data Acquisition). SCADA systems supervise the different components running in the system and have functions like controlling equipment, collecting data from different devices, asking signals, detecting state and checking historical data. The system consists of a module of SRAM and two CPU modules of the same type which are configured by the system to send heat signals data of a dual CPU.

III.SYSTEM DESCRIPTION AND METHODOLOGY FOLLOWED

This Smart Drainage System is designed to use automation to replace manual work in storm drain cleaning, which is critical in all industrial applications. This system aims mainly at drain pipes which are used for disposing of rain water off of the surface road. Smart Drainage system is used to remove the building up of silt in the drains and it uses an automated system that collects solid wastes if present to clean and control the flooding of road and water levels of drain.

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Since the purpose of this project is to design a fully automatic drainage system, therefore any human interference during the operation of this system was tried to be avoided. To achieve this primary goal a logo PLC was employed. Along with this a water pressure which is run by a single DC gear motor used as a water pump. Toxic gases sensed by the gas sensor, the level of the liquid waste senses by liquid level sensor and the weight of the solid waste are measured by a load cell.

To overcome the drawbacks of present drainage system and to save human life we implement this automatic industrial drainage system. This proposed concept is to replace the manual work done in the drainage pipe cleaning by automated system. 2. PLC is the major controlling unit and the drainage level is monitored by supervisory control and data acquisition technique. 3. Automatic drainage water pump monitoring and control system consists of Solenoid valve, gas exhauster, level sensors. 4. The gas sensor is a device that detects the presence of gases in the drainage pipe area. The toxic and non-toxic gases were separated, by using the gas exhauster. The level sensor get activated, to check the water level and the gas concentration created inside the pipe.

IV. FUTURE SCOPE

We gathered information and equipment required for the Automatic Drain cleaning system. As the project has been based on the concept, to integrate the benefits for human health, societal concerns and national cleanliness policy. Therefore, it covers many sections of proportionate benefits to the all sphere of our present life.

For Industry our project :- as being new in the market network will provide the entrepreneurs the much-needed ideas to blend the technology with societal benefits and harness the market. As a nation we are focusing on the Public benefits in the policy making and providing the young generation the employment and environment safety. While being a high-market potential project conserves the profit for the industry section with the advance of providing the corporate social benefits.

For society :- Sanitations is one of the very basic amenities required for the basic living of a man and providing with such a technological and economical instrument which can change the pathetic sewerage condition of the town and cities of mediocre India. With such a potential instrument of employment generation in the society through industry cooperation, these products land you in the win-situation for the people.

V. RESULT AND DISCUSSION

The system is implemented in accordance with the aforementioned methods. When the solid waste weight exceeds the specific limit which was predetermined, a pressure water pump started running and the waste flows further by clearing the blockage. Thus the solid waste is removed. In the liquid waste tank a liquid level sensor is attached which detects the liquid level and opens the solenoid valve when the level exceeds a predetermined level. The gas sensor is always on and senses the toxic gases concentration on the air. When the concentration of the toxic gas on the air reaches 40% of the air density, an exhaust fan is started to run to flow out the toxic gasses.

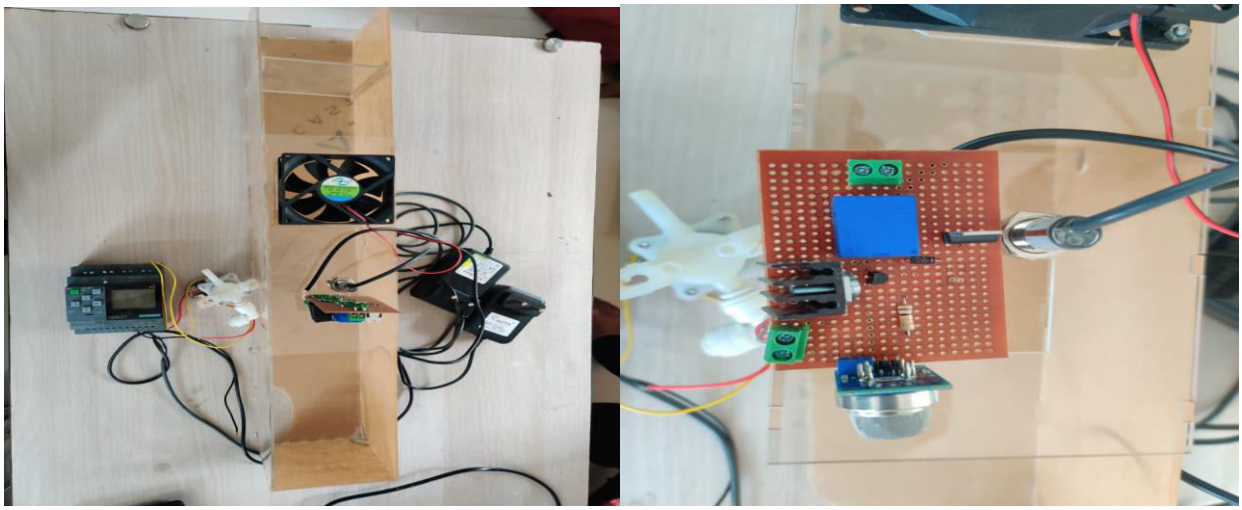

Fig 2. Real project photos

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VI.CONCLUSION

The prototype of the system here deals with the design and implementation of a PLC concept for an automated drainage system. When the solid waste weight exceeds the specific limit which was predetermined, a water pump started running and the waste flows off. Gas sensor is always on and senses the toxic gases concentration on the air. An exhaust fan is started to run to flow out the toxic gasses when the concentration reaches 40% of the air density. This project may be developed with the full utilization of men, space, machines, materials & money. This system was designed, fabricated successfully, and also tested. It works satisfactorily. In the future, such types of automated systems will have more demand.

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