



Automatic Detection of Liquids and Transfer to Respective Silos

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ABSTRACT: Large food processing plant or fluid based industry uses different ingredients (liquids) for making finished products. Every industry has reservoir or silos to store different liquids. The raw material (liquid) comes inside the industry through the vehicle and the filling of liquid into respective silos is done manually. In case of improper guidance or no guidance, there can be accidental mixing of two liquids. This project provides a solution by providing automatic guidance so that there is no chance of error by introducing zigbee which is a new trending technology. In this proposed work, data transfer is processed between the liquid detection module and the vehicle module. The viscosity value of the liquids varies from one to another. Here the liquid coming into the industry is passed through the liquid detection module which identifies the liquid in the vehicle. This module sends information to vehicle module through zigbee. Once the data is received from liquid detection module, the vehicle module displays the name of the silo where it has to be unloaded. Finally, the operator is automatically directed towards the respective silo.

KEYWORDS: Zigbee ,Hall effect sensor, Water Flow Meter

I.INTRODUCTION

An embedded system is designed to perform one or a few dedicated functions with real-time computing system. It is embedded as part of a complete device mainly including hardware and mechanical components. A general-purpose computer, is designed to be flexible and to meet a wide range of end-user needs. Embedded systems are controlled by more than one main processing cores that is typically either a microcontroller or a digital signal processor (DSP). The key characteristic is to handle a particular task, which may require very powerful processors. For example, air traffic control systems may be usefully viewed as embedded, even though they involve mainframe computers and dedicated regional and national networks between airports and radar sites. In the introduced system embedded system is used to automate the process of filling. Here, two modules are proposed to facilitate the industry in liquid identification and filling process. The main principle behind liquid detection is “Hall effect” used in water flow meter which states that ‘Whenever a current carrying conductor is placed in the magnetic field perpendicular to the flow of liquid, a voltage is induced in it. This model uses the Hall effect principle to trigger the pulse and pulse counter counts the number of rotations. The number of rotations varies according to the viscosity of the liquid. The filling process is accompanied by vehicle module which is programmed to stop at the silo where the detected liquid is to be unloaded.

II.PROPOSED SYSTEM

Proposed system will work based on the viscosity values of the liquids .The viscosity values of different liquids are different. Based on these values the number of rotations in the flow meter varies. Thus based on these values the signal is sent to the driver and he is automatically directed towards respective silos.

The proposed system consists of two modules. One module is device module and another one is vehicle module. The device module is for checking the type of the liquids coming inside the industry as a raw material. The first module consists of a Water flow meter connected to microcontroller. The flow rate of the liquid through the flow meter is controlled by the solenoid valve which acts as an on-off controller. The flow meter consists of rotor which rotates as the liquid flows through it. The number of rotations of rotor is based on the viscosity of the liquid. Zigbee is used to transmit this information from device module to the vehicle module. The vehicle module receives the signal based on

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the liquid present in the lorry vehicle. Based on the information received from the first module, the vehicle will be automatically directed towards the respective silo.

i) BLOCK DIAGRAM

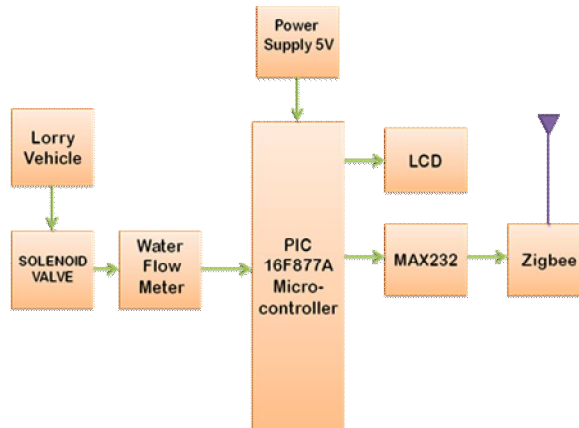


Fig. 1: Fluid detection module

In the block diagram Fig 2, the device module is shown. This module detects the type of liquid coming inside the industry as a raw material in the lorry vehicle. It consists of a container containing liquid to be tested. This liquid is allowed to pass through a solenoid valve which acts as an on-off controller and controls the rate of flow of liquid. It then passes through a water flow meter inside which the rotor rotates and the Hall effect sensor induces a voltage in the rotor thus producing pulse which triggers the pulse counter and counts number of rotations of rotor in 10 second and also identifies the liquid. The ranges of number of rotations differ for different liquids. The number of rotation depends on viscosity of the liquid being tested. Zigbee is used to transmit information to the vehicle module to reach respective silos.

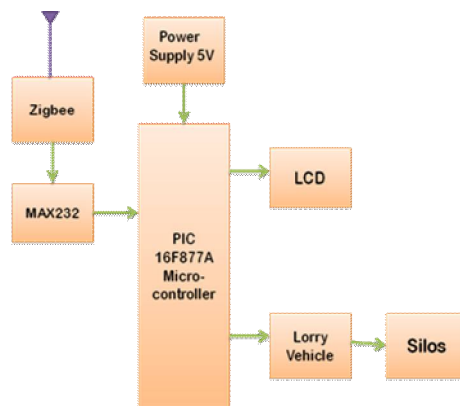


Fig. 2: Vehicle module

In the block diagram Fig 2 shows a vehicle module. It consists of receiver zigbee, microcontroller, relays and LCD. After the detection of liquid, the first module sends the signal to vehicle module. The signal received is given to the microcontroller which gives instruction to LCD to display the required silo number/name where the vehicle has to unload the liquid. Thus the vehicle is automatically directed to the silo without any external guidance.

ii) WORKING

The model consists of 2 modules i.e. device module and vehicle module. The device module consists of a container in which raw liquid is present. This liquid is allowed to flow through a solenoid valve which acts as an on-off controller to control the liquid flow rate. Then the liquid passes through water flow meter inside which a rotor rotates and hall effect sensor triggers the pulse and counts the number of rotations in case of particular liquid. The



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Vol. 6, Special Issue 3, November 2017

number of rotations depends on the density of liquid. The output of flow meter is given to microcontroller which displays the number of rotations in 10 seconds for different liquids. Here the zigbee from device module sends the signal to the zigbee in the vehicle module. The signal received by the vehicle module tells it the respective silo where it has to reach and empty the load and the vehicle is automatically directed toward that silo.

II. MATERIALS AND METHOD

Features of PIC microcontroller:

- Only there is 35 single-word instructions to learn
- All single-cycle instructions are there except for program branches
- Operating speed is DC – 20 MHz and clock input DC – 200 ns instruction cycle
- Up to 8K x 14 words of Flash Program Memory, 368 x 8 bytes of Data Memory (RAM) and 256 x 8 bytes of EEPROM Data Memory.
- 10-bit space and 8-channel Analog-to-Digital converter (A/D)
- It has Brown-out Reset (BOR)
- It has 100,000 erase/write cycle Enhanced Flash program memory
- It has 1,000,000 erase/write cycle Data EEPROM memory
- Data EEPROM Retention is greater than 40 years
- It is self-reprogrammable under software control
- It has Low-power and high-speed Flash/EEPROM technology
- It has wide operating voltage in the range (2.0V to 5.5V)

Zigbee

ZigBee is a wireless technology developed as an open global standard mainly to address the unique needs such as low-cost and low-power wireless M2M networks. The ZigBee standard operates on the IEEE 802.15.4 having physical radio specification and operates in unlicensed bands including 2.4 GHz, 900 MHz

The ZigBee protocol communicates data through RF environments that are common in commercial domestic and industrial applications. The features of ZigBee protocol is:

- It has low duty cycle providing long battery life
- It has Direct Sequence Spread Spectrum (DSSS)
- It has up to 65,000 nodes per network
- It has 128-bit AES encryption for secure data connections
- It has Collision avoidance, retries and acknowledgements.

Solenoid Valve

A solenoid valve is a mechanically operated valve which is controlled by an electric current through a solenoid. In two-port valves, the flow is switched on or off. Solenoid valve are the frequently used control device for liquids and their tasks are to shut off, release, dose, distribute etc. Solenoids offer fast and safe switching, high reliability, long service life, good medium compatibility of the materials used, low control power and compact design. If the valve is open, then the two ports are connected and liquids are allowed to flow between the ports whereas if the valve is closed, then ports are isolated i.e. it restricts the flow.

Specification- orifice 2.5 mm with 24v dc and pressure range of 0- 120 psi.

Water Flow Meter

The water flow meter consists of a plastic valve body, a water rotor and a hall-effect sensor. When the water flows through the rotor, rotor rotates and the speed of the rotor changes with a different rate of flow. The hall-effect sensor gives output for the corresponding pulse signal.

This type of sensor can be of different diameters, water pressure (MPa) and flow rate (L/m) ranges. The sensor that we used has 20mm diameter, <1.75Mpa water pressure and ~30 L/m flow rate range.



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Principle

The water flow meter is based on Hall Effect principle. The voltage is induced in the conductor transverse to electric current and magnetic field perpendicular to the conductor. Hall effect sensor is utilized in the water flow meter using small propeller shaped rotor.

The liquid passes against the fin of rotor causing it to rotate. The shaft of the rotor is connected to the Hall effect sensor. The Hall effect sensor has a current flowing coil and magnet connected to the shaft of the rotor. Thus the voltage is induced in the rotor. In this for 1L of liquid/meter, the output is 4.5 pulse. This is due to the changing magnetic field. Thus the number of pulses can be measured.

The 3 wires coming out of flow meter are-

- Red wire- 5v dc wire
- Black wire- ground wire
- Yellow wire- signal wire

When the flow meter detects the pulse, it triggers pulse counter and counts the number of rotations for the particular liquid.

III. RESULT AND DISCUSSIONS

In the proposed system, all the inconvenience are overcome by using new method of liquid detection. The entire system consists of 2 sections such as Liquid detection module, Vehicle module. The liquid detection module detects the type of liquid coming inside the industry as a raw material in the lorry vehicle. It consists of a container containing liquid to be tested. The liquid passes through a water flow meter inside which the rotor rotates and the hall effect sensor induces a voltage in the rotor thus producing pulse which triggers the pulse counter and counts number of rotations of rotor in 10 second and also identifies the liquid. The range of number of rotations differs for different liquids. The number of rotation depends on viscosity of the liquid being tested. Zigbee is used to transmit information to the vehicle module to reach respective silos.

The vehicle module consists of receiver zigbee, microcontroller, relays and LCD. After the detection of liquid, the first module sends the signal to vehicle module. The signal received is given to the microcontroller which gives instruction to LCD to display the required silo number/name where the vehicle has to unload the liquid. Thus the vehicle is automatically directed to the silo without any external guidance.

OUTPUT

The number of rotations per 10 seconds for every liquid is displayed on the LCD of liquid detection module. The signal is sent from liquid detection module to the vehicle module. The microcontroller in the vehicle module gives instruction to the LCD to display the required silo name/number where the vehicle has to unload the liquid. Thus the vehicle is automatically guided towards respective silo. The range of rotation and distance travelled by vehicle module is below:

LIQUID	NO.OF ROTATION (10 SECS)	DISTANCE
WATER	180-1000	60 meters
OIL	1-180	120 meters

IV. CONCLUSION

Any misstep or misapprehend in the industry causes a huge loss by accidental mixing of liquid. Hence it requires an effective strategy to reduce any misstep. Till now, there is no automatic system of transferring the raw material which is coming inside the industry into their respective silos and is done manually. So, keeping in the view of the above consideration the scheme is implemented which is found to work satisfactory and efficiently.

The project “THE AUTOMATIC DETECTION OF LIQUID AND TRANSFER TO REPECTIVE SILOS “ is designed to reduce the human error and avoid accidental mixing of different liquids. It is a system which automatically detect the type of liquid coming inside the with help of water flow meter and sends the signal to vehicle through ZigBee so, that the vehicle can be automatically guided to the respective silos. It is simple in nature and is a low cost device.



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