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FORM 2
THE PATENT ACT 1970
(39 of 1970)
&
The Patents Rules, 2003
PROVISIONAL/COMPLETE SPECIFICATION
(See section 10 and rule13)

1. TITLE OF THE INVENTION: AUTOMATIC FLOW RATE MEASUREMENT AND CONTROL OF WATER FLOW METER USING TELEMETRY

2. APPLICANT(S):

Sl.No.	NAME	NATIONALITY	CONTACT ADDRESS
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3.PREAMBLE TO THE DESCRIPTION

COMPLETE

The following Specification describes the invention and the manner in which it is to be performed:

FIELD OF THE INVENTION

The Present invention is related to develop a new automatic meter for reading water flow rate using GSM module.

BACKGROUND OF INVENTION

Water meter is a device for measuring and registering the volume of water that passes through the pipe or outlet. It is both mechanically and electrically controlled meter. In many developed countries water meters are used to measure the volume of water used by residential and commercial building that are supplied with water by a public water supply system. Water meters can also be used at the water source, well, or throughout a water system to determine flow through a particular portion of the system. The water metering device has a drawback that since it has been located in an open surrounding which leads to absence of continuous monitoring it can be easily tampered by the civilians. Due to absence of continuous monitoring the authorities are unable to find the illegal users. The billing system that is used for this kind of meter are conventional type, hence a person should be assigned to visit each home/building/industry to obtain the readings for calculating the billing amount. This processes need more time and sometime human-error can occurred during this process. Hence the billing system has become inaccurate and inefficient. Here we developed a new technique for acquiring the meter reading automatically, transfer and receive data from central unit through a GSM module.

PRIOR ART

The various advance have been done over the water meter till these years. A three set of algorithm have been developed in order to detect the tampering in a water meter by Iñigo Monederoa. The NGB (NEXT GENERATION BROADCASTING) is used for developing a wireless automatic meter reading system by Meng Liu. The system uses the existing set-top box or digital TV interface to access the wireless transceiver module, the user interface can use the existing interactive TV platform, the bills and payment can be done through TV set. The measurement are obtained by converting the water velocity into electrical signal from the turbine by Nusrat Sharmin Islam. An 8051 microcontroller is used as a microcontroller unit. The GSM module is used for transferring and receiving the data between the modules through SMS. And a flow regulation unit is used for control the water flow in the meter. The central server is built on LINUX operating system with JAVA as a programming language. ORACLE 10g is used for

database. The automatic remote water meter is interfaced with the Bluetooth which is considered to be used within a short range by X. Zhaoyin. A new automatic water meter dial have be developed by algorithm for print wheel diagram and pointer location based on Fourier transformation by Zhijia Zhang. The flow rate is obtained by a JT-121 flow sensor paddle Wheel type Polymer body Flow sensor by YOGENDRA P JOSHI . This flow sensor give the output in square wave form and the microcontroller will convert the value in to decimal digits. Techniques of measuring water flow rates with the help of neural networks had also been proposed. A technique of measuring flow rate in Air-Water Horizontal Pipeline with the help of Neural Networks by Shiqian Cai. In this paper the Kohonen self-organising feature map (KSOFM) and the Multi-layer back propagation network (MBPN) were applied in a hybrid network model to measure the flow rate of individual phases in horizontal air-water flow.

PRIOR ART

RELATED PATENTS

1. **20160216141** - Methods and apparatus for fluid flow measurement- US-28.07.2016
2. **WO/2016/077509** - Interactive water monitoring system - 19.05.2016
3. **ZA201104341** - Water meter system and method of using a water meter for dispensing water- 10.06.2011
4. **KR101627793** - A Water meter and a waterworks control system using the same - 28.11.2014
5. **CN105258739** - Method of monitoring water consumption by intelligent water meter- 29.09.2015
6. **CN105206009** - Novel automatic meter reading device for intelligent water meter- 10.06.2014

My invention is totally different from the existing systems. It is new, explained in clear language and has industrial application.

SUMMARY OF THE INVENTION

In this proposed system we developed a new technique for acquiring the meter reading automatically, transfer and receive data from central unit through a GSM module. A Hall effect sensor is placed close to the water meter turbine where it can acquire the magnetic pulse send from the magnet and send it to the arduino nano (ATmega328 processor) where it convert the magnetic pulse to an actual flow rate. The converted data will be send to the PC through the

GSM module. The Arduino nano is interfaced with a Solenoid valve, when any illegal activities like tampering is performed the valve will stop the flow rate and an alert message will send to the authority.

BRIEF DESCRIPTION OF THE FIGURES

Fig: 1 is the block diagram of transfer unit.

Fig: 2 is the Block diagram of receiving unit

Fig: 3 is the Working Flow chart of Transceiver End.

Fig: 4 is the Working Flow Chart of Receiver End.

Fig: 5 is the 2D Sketch view of Water Flow Meter.

DETAILED DESCRIPTION OF THE FIGURES

Fig: 1 represents that the water flow meter is used to measure the volume of liquid flow through the valve. The Hall effect sensor is used to find the number of rotation done by the turbine in the water flow meter and The Arduino nano is used to calculate the flow rate, detect tampering and signal the solenoid valve to close and open. The GSM act as transceiver module and send the data and receive the signal to and from the receiver module. The Solenoid Valve is used to close the valve when tampered and open the valve when the tampering is rectified.

Fig: 2 represent the block diagram of receiver unit. The GSM module act as a two way data and signal conveyer from transceiver module to Arduino Nano and from Arduino Nano to the transceiver module. The Arduino Nano used to transmit the deliver data from the GSM to the display /PC and then send the signal back to the GSM module. The Display/ Pc will display the data of measured readings from the flow meter.

Fig: 3 represent the working flow chart of transceiver end. First the device check the flow rate of water and check for tampered. If the device is tampered it close the valve and send a warning message to the authority. If not tampered it send the flow rate readings to the central unit and with a time delay the process continuous routinely.

Fig: 4 represent the working flow chart of receiver end. The device first checks the serial connection for the data that have been send by the transceiver end. If the data is available it will read

the message and filter the values from the SMS. After that the graph will be plotted and the rate of consumption will be checked.

Fig: 5 represent the 2D Sketch view developed Water Flow Meter

DETAILED DESCRIPTION

A Water flow meter is a device used for measuring and registering the quantity of water that pass through a pipe outlet. The flow rate are calibrated in both cubic metres (m³) or litres and cubic feet (ft.³) or gallons. The process of measuring the water flow is called water metering. As water flows through the meter it tends to rotate the turbine fins, where a magnet is attached in the top of it. The Turbine is an individual rotating object that is made up of plastic, which is responsible for obtaining the flow rate in the water meter. The flow rate is acquired by the rotational movement of the turbine engaged by water through the turbine fins. A magnet is attached in the top of the turbine, which is in a close contact with the Hall Effect sensor. When the turbine engage to rotate, the magnetic Pole come in contact with the sensor and a magnetic pulse is generated and obtained by the sensor. The Base of the water meter is an individual brass component that allows the water to flow through it, a plastic seal is placed over its to prevent the water leaking out of it and to prevent the turbine from wobbling. A small cylindrical iron is attached in the middle of the base to prevent the uneven rotation and turbine dislocation when the water is flowing through the base.

A Hall Effect sensor is a transducer that varies its output voltage in response to a magnetic field. In other words it is a device which convert magnetic or magnetically encoded information in to electrical signal. The sensor is positive and digital is interfaced with the 10k resistor in order to prevent the circuit from facing high voltage by reducing current flow, and, at the same time, act to lower voltage levels within circuits. When a beam of charged particles passes through a magnetic field, forces act on the particles and the beam is deflected from a straight path. The flow of electrons through a conductor is known as a beam of charged carriers. When a conductor is placed in a magnetic field perpendicular to the direction of the electrons, they will be deflected from a straight path. As a consequence, one plane of the conductor will become negatively charged and the opposite side will become positively charged. The voltage between these planes is called Hall voltage. When the force on the charged particles from the electric field balances the force produced by magnetic field, the separation of them will stop. If the current is not changing, then the Hall voltage is a measure of the magnetic flux density. Basically, there are two kinds of Hall effect sensors. One is linear which means the output of voltage linearly depends on magnetic flux

density; the other is called threshold which means there will be a sharp decrease of output voltage at each magnetic flux density.

The water meter is interfaced with a hall effect sensor in order to measure the flow rate. When the water runs through the meter it tends to rotate the turbines fin. A magnet is attached to the top of turbine. When the turbine start to rotate the magnet start rotating relatively to it. A hall effect sensor is placed near to the magnet in a close magnetic field, the sensor will start receiving the magnetic pulse which will transfer the pulse to the arduino nano. A program have been developed in the arduino nano to perform the calculation where the program converts the magnetic pulse into actual flow rate. The arduino nano is interfaced with a GSM module. GSM module is a mobile communication modem that act as a two way data transmission module with a SIM attached to it, which establish communication between a computer and a cellular network and transfer data via SMS. The ARDUINO will send the data to the GSM module and with a time delay the module will send the data to receiving end. There was GSM module will be interfaced with the ARDUINO NANO which is connected to the computer/display. The meter is attached with the solenoid valve in term when the meter is tampered the module will send the alert message to the computer and the valve will be closed by the solenoid valve and remains close until the tamper is rectified.

5. DATE AND SIGNATURE

VELTECH Dr.RR &Dr.SR UNIVERSITY	*  01/12/16
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1. The Proposed System consists of Water flow meter, Hall effect sensor, Arduino Nano, Solenoid valve and GSM module. It is used to measure the flow of water through the device. Hall Effect Sensor starts receiving pulse from the magnet as soon as the turbine starts rotating. The Arduino Nano is used to perform the Flow Rate Conversion and the GSM SIM900 Module is used to transfer the data to the main server. The Solenoid Valve is used to stop the flow in case of any manipulation or damage to the device. MATLAB Software is used to display and process the received data from the transfer unit.
2. The System as claimed in Claim1, the Water Flow Meter is used to measure the volume of liquid flow through the valve, the hall effect sensor is used to find the number of rotation done by the turbine in the water flow meter, the arduino nano is used to calculate the flow rate, detect tampering and signal the solenoid valve to close and open, the GSM act as transceiver module, the Solenoid Valve is used to close the valve when tampered and open the valve when the tampering is rectified.
3. The System as claimed in Claim1, the GSM module is act as a two way data and signal conveyer from transceiver module to Arduino Nano and from Arduino Nano to the transceiver module.
4. The System as claimed in Claim1, the Arduino Nano used to transmit the deliver data from the GSM to the display /PC and then send the signal back to the GSM module
5. The System as claimed in Claim1, the water meter is interfaced with a hall effect sensor in order to measure the flow rate, when the water runs through the meter it tends to rotate the turbines fin.
6. The System as claimed in Claim1, a magnet is attached to the top of turbine, when the turbine start to rotate the magnet start rotating relatively to it, a hall effect sensor is placed near to the magnet in a close magnetic field, the

sensor will start receiving the magnetic pulse which will transfer the pulse to the arduino nano.

7. The System as claimed in Claim1, a program have been developed in the arduino nano to perform the calculation where the program converts the magnetic pulse into actual flow rate, the arduino nano is interfaced with a GSM module.
8. The System as claimed in Claim1, the arduino will send the data to the GSM module and with a time delay the module will send the data to receiving end, there was GSM module will be interfaced with the arduino nano which is connected to the computer/display, the meter is attached with the solenoid valve in term when the meter is tampered the module will send the alert message to the computer and the valve will be closed by the solenoid valve and remains close until the tamper is rectified.

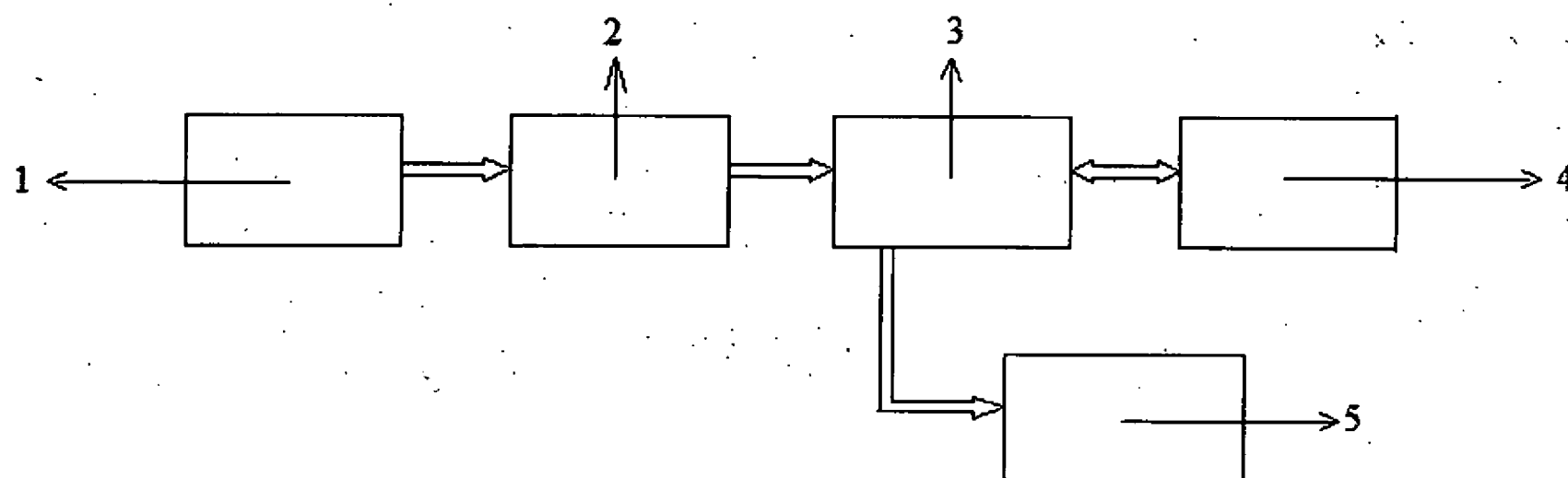


7. ABSTRACT OF THE INVENTION

Automatic Flow Rate Measurement And Control Of Water Flow Meter Using Telemetry is a technology for controlling the flow of water along with the sufficient monitoring of meter and send the readings automatically by SMS from a remote place without any human involvement. The defect with the manual water meter is, it is not safe and it can be easily tampered and manipulated by the civilians. In this invention, a new methodology has been introduced by eliminating the manual meter and placing a newly developed flow rate detecting device which consist of Hall Effect Sensor, Arduino Nano, GSM module (Global System for Mobile communications) over the water meter base for obtaining the measurements. The Hall Effect sensor is used to obtain the magnetic pulse from South Pole of the turbine magnet and ARDUINO NANO is used to convert the received pulse in to actual flow rate and control the device by the program. GSM module is used for sending and receiving the data via SMS. If the meter is manipulated or tampered, the Arduino Nano will send an alert message to the authority. Immediately after the message sent the Arduino will initiate the solenoid to shut the valve. Hence by using the device illegal consumption of water will be stopped. Problems regarding the water crisis in future will be reduced. A prototype of the device is under developed and analyzed.

FIG: 1

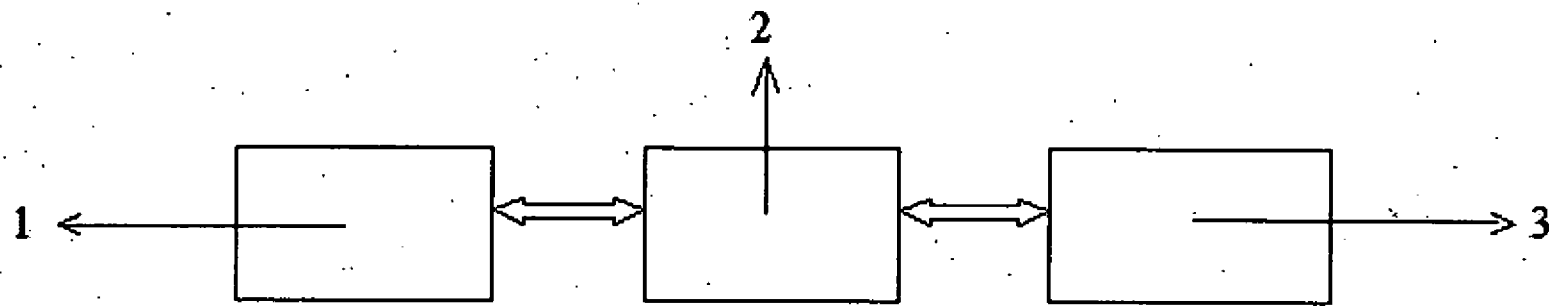
BLOCK DIAGRAM OF TRANSFER UNIT



1. Water flow meter
2. Hall effect sensor
3. Arduino nano
4. GSM module
5. Solenoid valve

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FIG: 2
BLOCK DIAGRAM OF RECEIVING UNIT

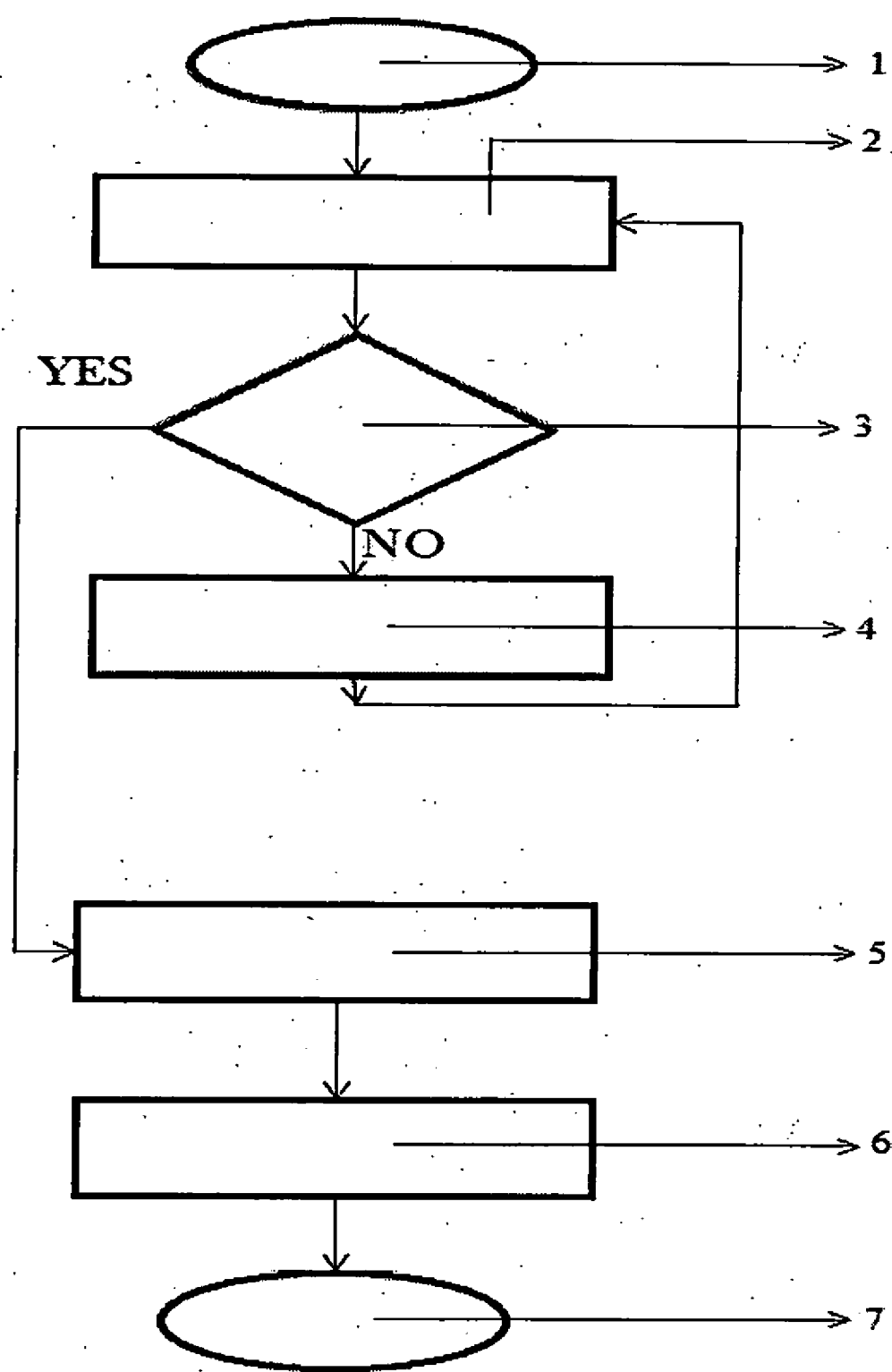


1. GSM
2. Arduino nano
3. PC display

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FIG: 3

WORKING FLOW CHART OF TRANSCEIVER END

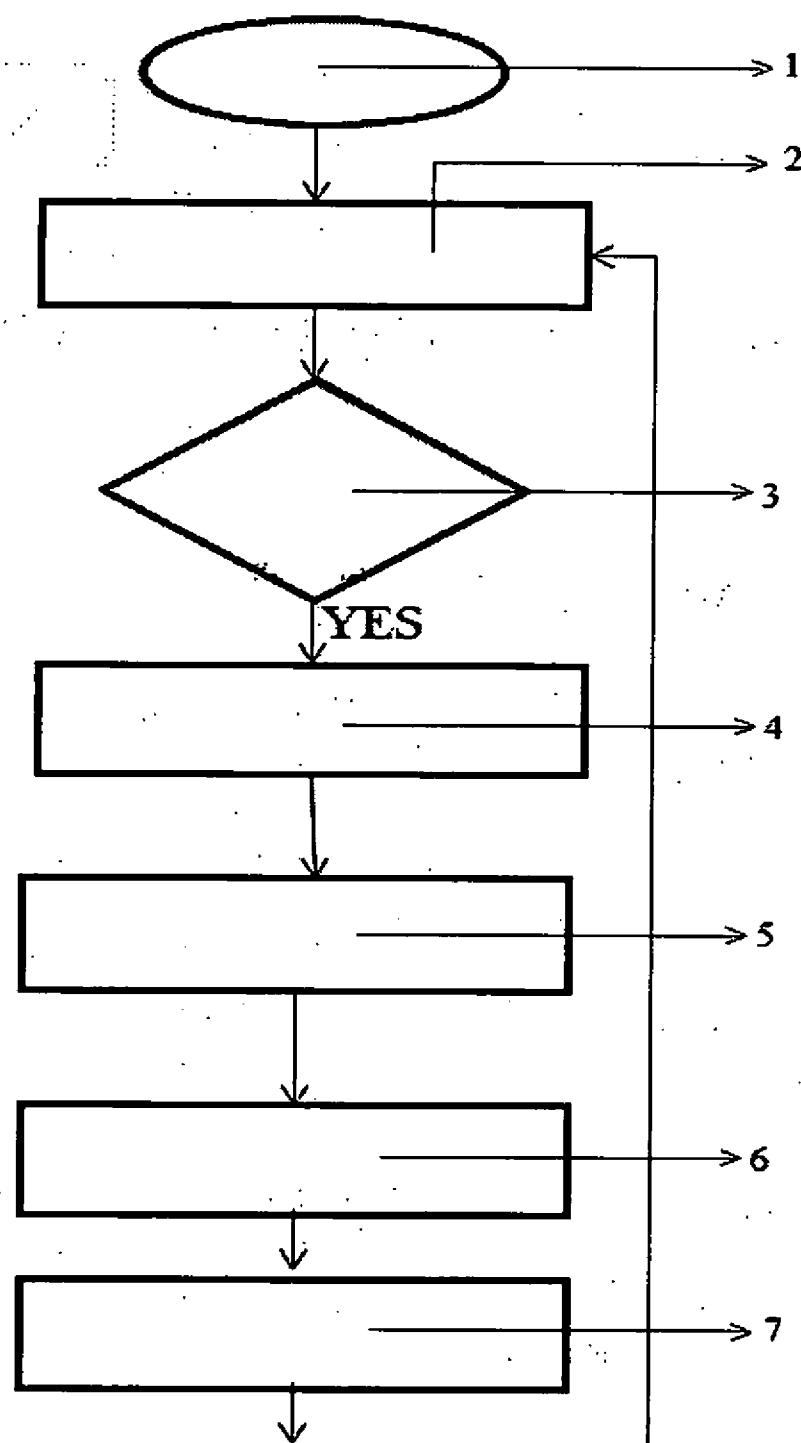


1. Start
2. Check flow rate
3. If tampered
4. Send sms
5. Close solenoid valve
6. Send warning SMS
7. Stop

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FIG: 4

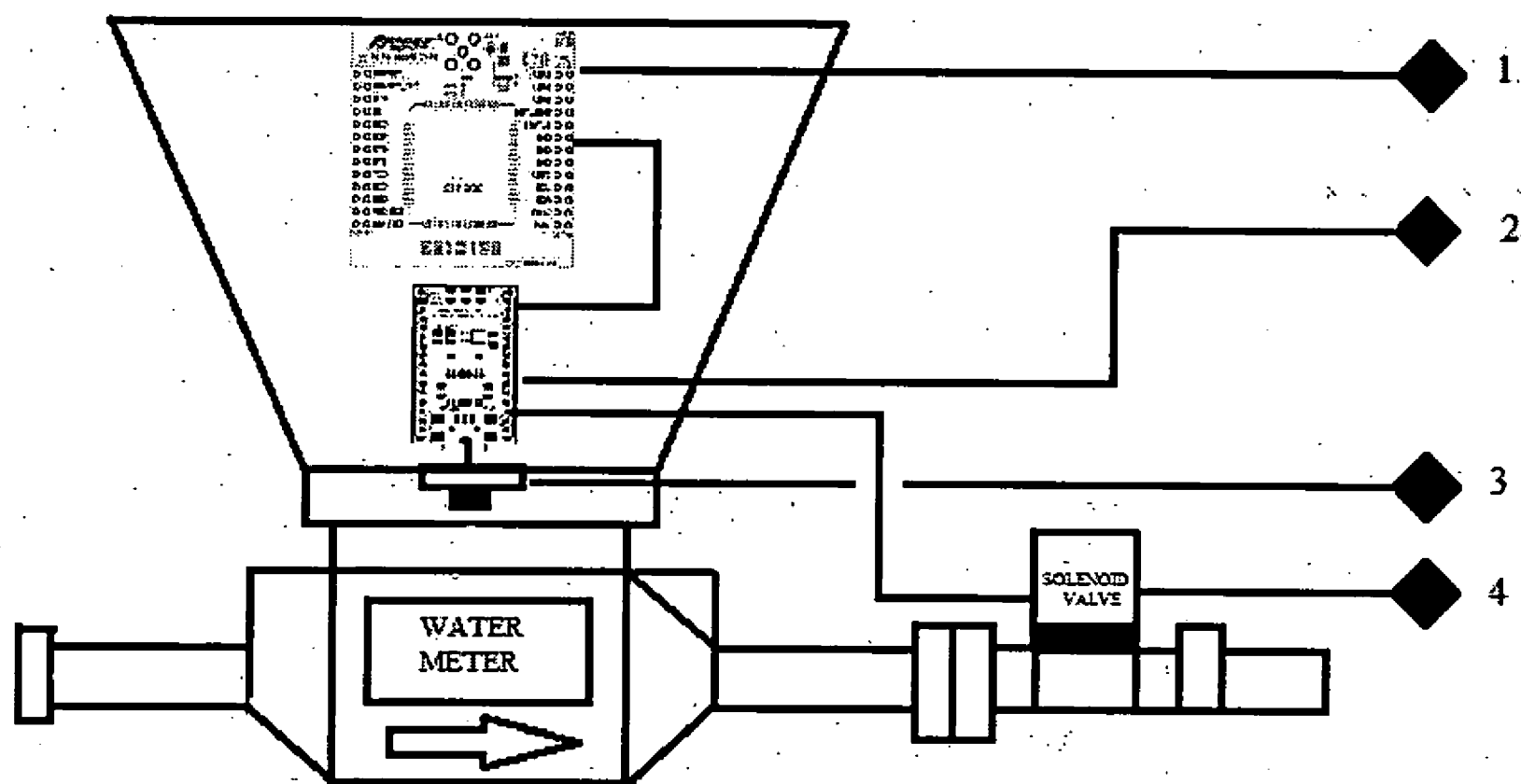
WORKING FLOW CHART OF RECEIVER END



1. Start
2. Check serial connection
3. If data available
4. Read SMS
5. Filter value from SMS
6. Plot graph
7. Check for consumption

FIG: 5

2D SKETCH VIEW OF WATER FLOW METER



1. GSM SIM900 MODULE
2. ARDUINO NANO
3. HALL EFFECT SENSOR
4. SOLENOID VALVE