

GSM BASED IRRIGATION MOTOR CONTROLLER

¹G.Jayakrishna, ²M.Sasikumar, Dr.G. Sreenivasulu

¹Professor, ²Assistant professor, ³Professor

Department of EEE,

Narayana Engineering College, Nellore, AP, India.

Abstract : Agriculture is the one of the biggest industry in India .Most agriculturist's crop or field is situated at far from the residence. Just to turn ON the pump motor they must go to the fields which are far away. The cost of transportation per year is very huge. Also it is time consuming and more human strain is involved.. The Arduino based GSM pump motor controller circuit takes a step towards agricultural development, which may bring delight among agriculturists. This paper presents a circuit model designed with minimal hardware components so that a beginner can accomplish it with ease. The circuit consists of power supply, which powers the whole setup. The arduino is the brain of the circuit, which take decisions and GSM modem which sends and receives text SMS and communicate with the user and relay which controls the motor. When a message "MOTOR ON" is sent from a registered mobile, then the motor will turn ON and then it sends a message about the status of the motor and If a message "MOTOR OFF", is sent, then the motor will turn OFF and then it will send the user a status message. We can also get various status messages of the motor, like temperature of the field, moisture, whether water is coming from motor or not. If power supply is available it sends message like system is ready to take commands.

Index Terms - GSM, Irrigation Motor, Arduino, Motor Controller.

I INTRODUCTION

The main objective of this paper is to present a mechanism to turn on or turn off the motor by using mobile phone from any place. The block diagram of Irrigation motor controller is shown in Fig. 1.

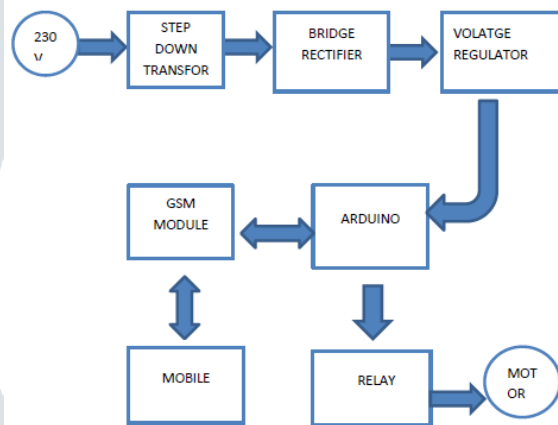


Fig. 1 Block diagram of GSM based Irrigation motor controller.

The GSM base irrigation motor controller mainly consists GSM Module, Arduino, Mobile phone, Relay, pumping Motor, Voltage Regulator, Bridge Rectifier, Step Down Transformer, Electrolytic capacitor, water sensor.

1.1 STEP DOWN TRANSFORMER

A 230V to 12V Step down transformer is used in this circuit.

1.2 RECTIFYING CIRCUIT: A diode bridge rectifier is used for converting AC into DC.

1.3 VOLTAGE REGULATOR

A voltage regulator is an electronic circuit that provides a stable DC voltage independent of the load current, temperature and AC line voltage variations. 7812 is a LOW DROP Voltage Regulator able to provide up to 1A of Output Current at a fixed 12V output voltage, Input Voltage Max:35V. A simple approach to recollect the voltage yield by a LM78XX arrangement of voltage controllers is the last two digits. It yields 5 volts. The "78" section is simply the tradition that the chip creators utilization to indicate the arrangement of controllers that yield positive voltage. Pin 1 (Input Pin): The Input pin is the pin that acknowledges the approaching DC voltage, which the voltage controller will in the long run direct down to 5 volts. Pin 2 (Ground): ground pin creates the ground for the controller. Pin 3 (Output Pin): The Output pin is the controlled 5 volts DC

1.4 ELECTROLYTIC CAPACITOR

An electrolytic capacitor (e-cap) is a polarized capacitor whose anode or positive plate is made of a metal that forms an insulating oxide layer through anodization. This oxide layer acts as the dielectric of the capacitor. A solid, liquid, or gel electrolyte covers the surface of this oxide layer, serving as the (cathode) or negative plate of the capacitor. Due to their very thin dielectric oxide layer and enlarged anode surface, electrolytic capacitors have a much higher capacitance-voltage (CV) product per unit volume compared to ceramic capacitors or film capacitors, and so can have large capacitance values. There are three families of electrolytic capacitor: aluminum electrolytic capacitors, tantalum electrolytic capacitors, and niobium electrolytic capacitors. The large capacitance of electrolytic capacitors makes them particularly suitable for passing or bypassing low-frequency signals, and for storing large amounts of energy. They are widely used for decoupling or noise filtering in power supplies and DC link circuits for variable-frequency drives, for coupling signals between amplifier stages, and storing energy as in a flash lamp. Electrolytic capacitors are polarized components due to their asymmetrical construction, and must be operated with a higher voltage (ie, more

positive) on the anode than on the cathode at all times. For this reason the anode terminal is marked with a plus sign and the cathode with a minus sign. In addition they can only tolerate low applied voltages. Applying a reverse polarity voltage, or a voltage exceeding the maximum rated working voltage of as little as 1 or 1.5 volts, can destroy the dielectric and thus the capacitor. The failure of electrolytic capacitors can be hazardous, resulting in an explosion or fire. Bipolar electrolytic (aka non-polarized) capacitors which may be operated with either polarity are special constructions with two anodes connected in series

1.5 RELAY

There are only four main parts in a relay as shown in Fig. 2. They are Electromagnet, Movable Armature, Switch point contacts, Spring. Relays have the exact working of a switch. So, the same concept is also applied. A relay is said to switch one or more poles. Each pole has contacts that can be thrown in mainly three ways. They are i) Normally Open Contact (NO) – NO contact is also called a make contact. It closes the circuit when the relay is activated. It disconnects the circuit when the relay is inactive. ii) Normally Closed Contact (NC) – NC contact is also known as break contact. This is opposite to the NO contact. When the relay is activated, the circuit disconnects. When the relay is deactivated, the circuit connects. iii) Change-over (CO) / Double-throw (DT) Contacts – This type of contacts are used to control two types of circuits. They are used to control a NO contact and also a NC contact with a common terminal

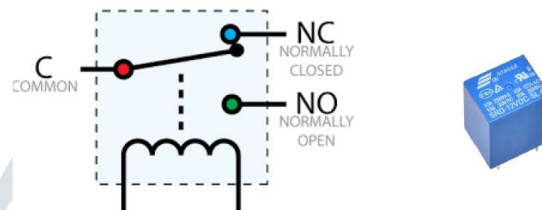


Fig. 2 Relay internal circuit Fig 2.9 Practical relay

1.6 ARDUNIO

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing. Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

FEATURES OF ARDUNIO

Inexpensive ;Arduino boards are relatively inexpensive compared to other microcontroller platforms.

Cross plat form: The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.

Simple, clear programming environment: The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with how the Arduino IDE works.

Open source and extensible software :The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries

Open source and extensible hardware - The plans of the Arduino boards are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money.

The Arduino Uno R3 is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. Arduino Uno R3 is shown in Fig. 3.

SUMMARY

	ATmega328
Microcontroller	
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 kB (ATmega328) of which 0.5 kB used by boot loader
SRAM	2 kB (ATmega328)
EEPROM	1 kB (ATmega328)
Clock Speed	16 MHz

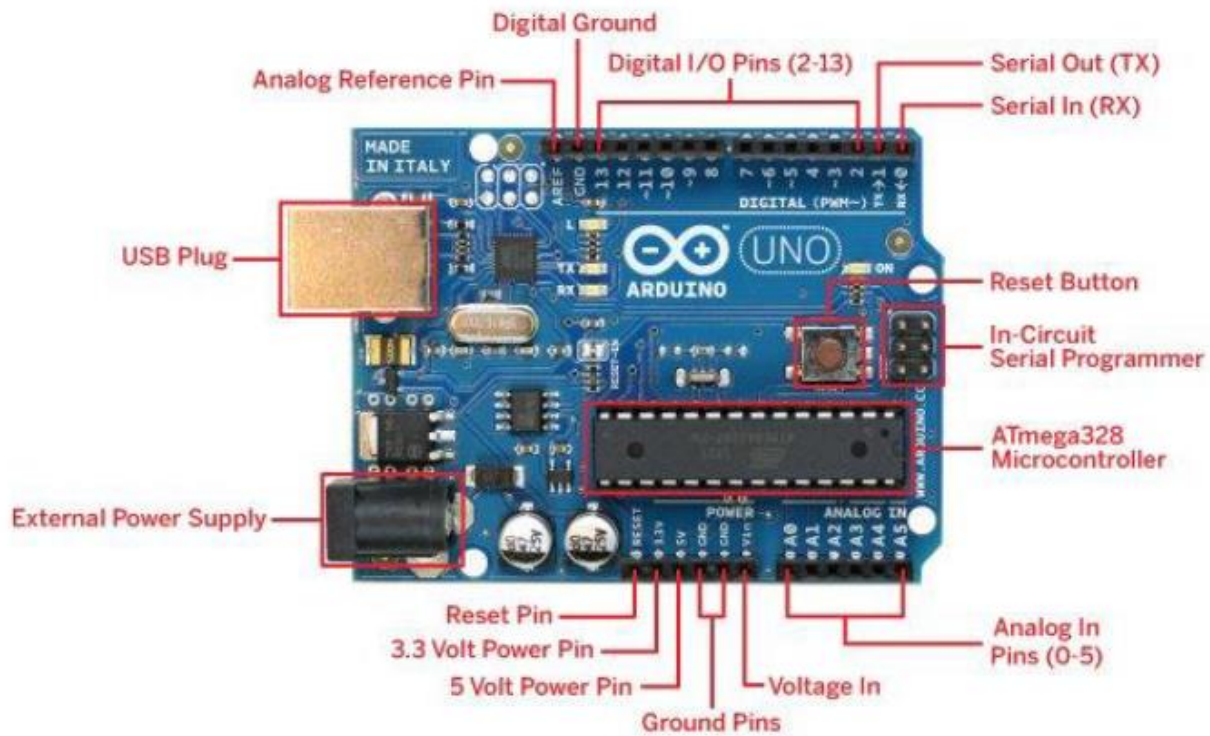


Fig. 3 Arduino uno R3.

1.7 GSM MODULE

GSM system was developed as a digital system using time division multiple access (TDMA) technique for communication purpose. A GSM digitizes and reduces the data, then sends it down through a channel with two different streams of client data, each in its own particular time slot. The digital system has an ability to carry 64 kbps to 120 Mbps of data rates. 19

- 1) GSM is a mobile communication modem; it stands for global system for mobile communication (GSM). The idea of GSM was developed at Bell Laboratories in 1970. It is widely used mobile communication system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands.
- 2) GSM system was developed as a digital system using time division multiple access (TDMA) technique for communication purpose. A GSM digitizes and reduces the data, then sends it down through a channel with two different streams of client data, each in its own particular time slot. The digital system has an ability to carry 64 kbps to 120 Mbps of data rates.
- 3) There are various cell sizes in a GSM system such as macro, micro, pico and umbrella cells. Each cell varies as per the implementation domain. There are five different cell sizes in a GSM network macro, micro, pico and umbrella cells. The coverage area of each cell varies according to the implementation environment.
- 4) TDMA technique relies on assigning different time slots to each user on the same frequency. It can easily adapt to data transmission and voice communication and can carry 64kbps to 120Mbps of data rate. The GSM module diagram is shown in Fig. 4.

GSM Architecture

- 1) A GSM network consists of the following components:
- 2) A Mobile Station: It is the mobile phone which consists of the transceiver, the display and the processor and is controlled by a SIM card operating over the network.
- 3) Base Station Subsystem: It acts as an interface between the mobile station and the network subsystem. It consists of the Base Transceiver Station which contains the radio transceivers and handles the protocols for communication with mobiles. It also consists of the Base Station Controller which controls the Base Transceiver station and acts as a interface between the mobile station and mobile switching centre.
- 4) Network Subsystem: It provides the basic network connection to the mobile stations. The basic part of the Network Subsystem is the Mobile Service Switching Centre which provides access to different networks like ISDN, PSTN etc. It also consists of the Home Location Register and the Visitor Location Register which provides the call routing and roaming capabilities of GSM. It also contains the Equipment Identity Register which maintains an account of all the mobile equipments wherein each mobile is identified by its own IMEI number. IMEI stands for International Mobile Equipment Identity.

1.8 GSM MODEM

A GSM modem is a device which can be either a mobile phone or a modem device which can be used to make a computer or any other processor communicate over a network. A GSM modem requires a SIM card to be operated and operates over a network range subscribed by the network operator. It can be connected to a computer through serial, USB or Bluetooth connection. A GSM modem can also be a standard GSM mobile phone with the appropriate cable and software driver to connect to a serial port or USB port on your computer. GSM modem is usually preferable to a GSM mobile phone. The GSM modem has

wide range of applications in transaction terminals, supply chain management, security applications, weather stations and GPRS mode remote data logging.



Fig. 4 GSM module

WORKING OF GSM MODULE:

From the below circuit, a GSM modem duly interfaced to the MC through the level shifter IC Max232. The SIM card mounted GSM modem upon receiving digit 22 command by SMS from any cell phone send that data to the MC through serial communication. While the program is executed, the GSM modem receives command „STOP“ to develop an output at the MC, the contact point of which are used to disable the ignition switch. The command so sent by the user is based on an intimation received by him through the GSM modem „ALERT“ a programmed message only if the input is driven low.

INTELLIGENT GSM DEVICE FOR AUTOMATION AND SECURITY

In these days, the GSM mobile terminal has become one of the items that are constantly with us. Just like our wallet/purse, keys or watch, the GSM mobile terminal provides us a communication channel that enables us to communicate with the world. The requirement for a person to be reachable or to call anyone at any time is very appealing. In this project, as the name says project is based on GSM network technology for transmission of SMS from sender to receiver. SMS sending and receiving is used for ubiquitous access of appliances and allowing breach control at home. The system proposes two sub-systems. Appliance control subsystem enables the user to control home appliances remotely and the security alert subsystem gives the automatic security monitoring. The system is capable enough to instruct user via SMS from a specific cell number to change the condition of the home appliance according to the user's needs and requirements. The second aspect is that of security alert which is achieved in a way that on the detection of intrusion, the system allows automatic generation of SMS thus alerting the user against security risk.

1.9 PUMP MOTOR

Single phase induction motors is used for pumping water.

1.10 WATER SENSOR

Water sensor is used to detect the status of water from the motor to be activated. It uses the 5v pin in the arduino and #pin 2 to detect the presence of water. The 5v pin gives 5v output and the #pin 2 acts as DIGITAL READ (which reads the signal given to the pin). This water sensor is placed in the outlet pipe of the kit motor. i.e., the terminal from the 5v pin of the arduino and the terminal from the #pin 2 and these two terminals are always in open circuit manner. In this water sensor, water will acts like a switch, when the water flows the motor then the connection is appeared between the two terminals in the pipe, then the 5v is appeared across the #pin 2 then it sends a message to the registered mobile i.e., „**water is coming**“. In case of any failure of motor ,when water is not coming from the motor then connection will lost between the two terminals of the arduino present in the outlet pipe then #pin 2 is connected to ground (0v),then the arduino will send a message to the registered mobile i.e., „**water is not coming**“. The main use of this water sensor is to get the status of the water. The given figure shows the circuit diagram of the water sensor. This water sensor is very efficient which uses a very low power of 5v dc. The Water sensor diagram is shown in Fig. 5. The circuit diagram of GSM based irrigation motor controller is shown in Fig. 7.

II OPERATION OF GSM CONTROLLED IRRIGATION MOTOR

Generally we are getting 230 volts, 50 Hz ac supply and it is given to the 12v step-down transformer, which step downs the 230v to 12v ac supply. The 12v is fed to a bridge rectifier (which consists of 2 pairs of diodes), which converts the 12v AC supply to DC supply. This consists of some ripples and these can be eliminated by passing through a electrolytic capacitor. The 12v DC supply is pass through a 7812 voltage regulator which regulates the voltage to 12V and this supply is used to fed the ARDUINO and the GSM MODEM. The GSM modem is connected to Arduino at pin #0 and pin #1, which are RX and TX respectively. Ground to ground connection is also established between Arduino and GSM modem. When the supply is given to the circuit (GSM based motor control using Arduino) then the program in the Arduino will run once and also the GSM module will make a connection will the network. This process will take 60 seconds of time and them the kit will send a message “System is ready to receive commands” to the registered mobile number. This means that our kit is ready to do work and this message also signs that there is supply to the motor too.

2.1 MOTOR ON CONTROL

When we send a message “/motor on/” from our registered mobile number to the kit then the GSM modem receives the text message then the Arduino reads the text message in the GSM module through RX pin of the Arduino. Then the digital pin #8 and pin #9 will go HIGH then the led connected to the pin #8 will glow and also 5v is given to the transistor then the transistor will activates and connects the ground to the 12v relay which closes the relay circuit this feds the 230v to the motor . When the motor will turned on then the kit will send back a acknowledge message to the registered mobile that the “MOTOR ACTIVATED” .This

means that message is transferred between the Arduino and GSM module through the TX and RX of the modules respectively. If water is coming from the motor then it sends “water is coming” otherwise it will send water is not coming” to the registered mobile number. Although we send “/motor on/” to the kit, but if there is no acknowledge message to the mobile then motor is not activated.

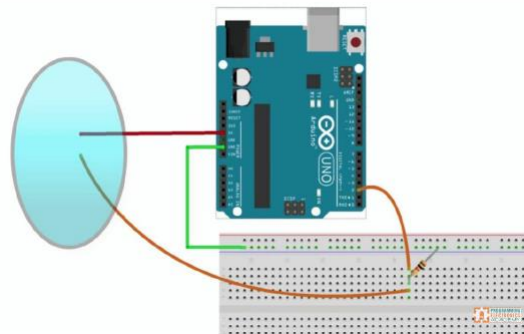


Fig. 5 Water sensor[1]

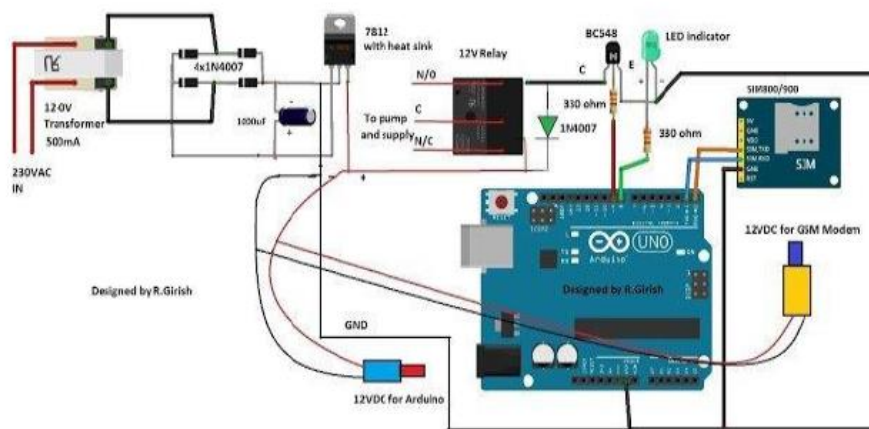


Fig. 6 Circuit diagram of a GSM control irrigation motor using Arduino[1].

2.2 MOTOR OFF CONTROL

When we send a message “/motor off/” from our registered mobile number to the kit then the GSM modem receives the text message then the Arduino reads the text message in the GSM module through RX pin of the Arduino. Then the digital pin #8 and pin #9 will go LOW then the led connected to the pin #8 will turned off and also 0v is given to the transistor then the transistor will deactivates this disconnects the ground to the 12v relay which opens the relay circuit, thus the motor will get turned off. When the motor will turned off then the kit will send back a acknowledge message to the registered mobile that the “MOTOR DEACTIVATED” .This means that message is transferred between the Arduino and GSM module through the TX and RX of the modules respectively. Although we send “/motor off/” to the kit, but if there is no acknowledge message to the mobile then motor is not deactivated. To know the status of the motor, when we send a message “/test/” from our registered mobile number to the circuit, the GSM modem receives the text message, the Arduino reads the text message in the GSM module through RX pin of the Arduino. Then the circuit will send back a acknowledge message to the registered mobile about the various status of the motor. This means that message is transferred between the Arduino and GSM module through the TX and RX of the modules

III EXPERIMENTAL RESULTS

Checking for availability of power.

When power is available, then the circuit will send the message “SYSTEM IS READY TO RECEIVE COMMANDS” to the registered mobile as shown in Fig. 7.

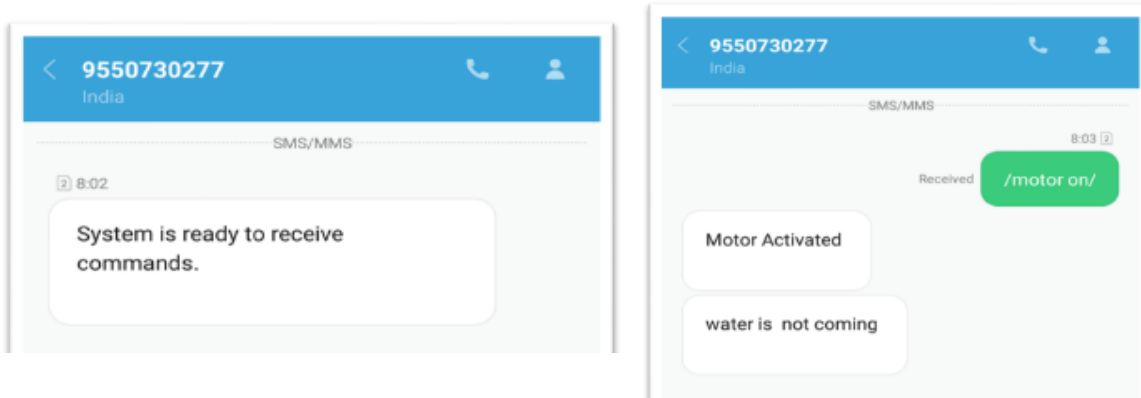
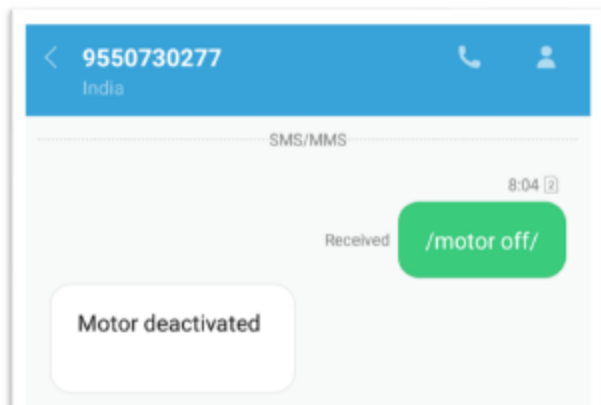
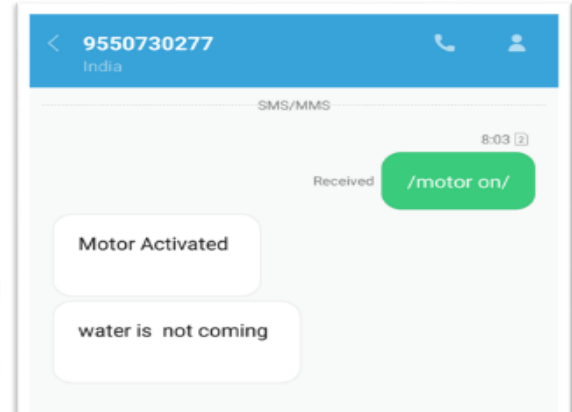


Fig. 7 Checking power supply is available.**Fig. 8 Turn on of motor****Turning on of a motor**

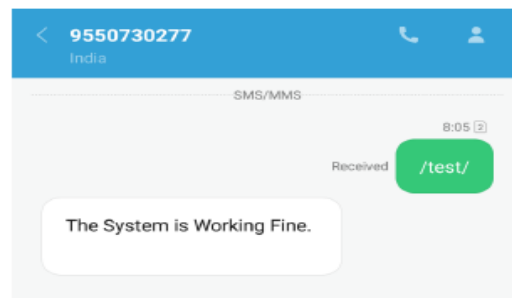
Motor can be turned ON by simply sending a message “/motor on/”. We also receive an acknowledgement message from the circuit, as “MOTOR ACTIVATED” as shown in Fig. 8.

Turning off of a motor

Motor can be turned ON by simply sending a message “/motor off/”. We also receive a conformation message as “MOTOR DEACTIVATED” as shown in fig. 9.

**Fig. 9 Turn off motor.****Fig. 10 Checking water is coming are not.****Checking water is coming from motor or not**

It does not require any command externally when motor is ON, water sensor detects whether water is coming or not and it sends a message to the user as “WATER IS COMING” when water is coming from motor, otherwise it will send “WATER IS NOT COMING”.

**Fig. 11 Water coming system working fine.****IV CONCLUSION**

This circuit requires less man-power, less power consumption, cost efficient, time saving, accuracy, compactness, precise, easy to operate, transportation cost reduces.

REFERENCES

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