Sixth International Conference on Emerging trends in Engineering and Technology (ICETET'16)
www.ijera.com
ISSN: 2248-9622, pp.35-39

RESEARCH ARTICLE OPEN ACCESS

Implementation of iot Interface for Customized Coffee Maker

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ABSTRACT
This thesis describes the design and development of a prototype to control the solenoid valve using mobile phone through global system for mobile communication (GSM) technology. This system allows the user to control the solenoid valve via mobile phone by sending commands in the form of SMS and receiving the feedback status as well. This system uses the user's mobile handset for control and therefore the system is more adaptable, cost-effective and also providing ubiquitous access for solenoid valve control. In this project, introduce an innovative application of valve of coffee maker automatically control using IoT (Internet of Things). The arduino UNO microcontroller with the integration of GSM provides the smart kitchen with the desired baud rate of 9600 bps. This type of machine can save our time and decrease wastage.
Keywords: Mobile handset, short message service (SMS), microcontroller, GSM modem, RS232 standard, AT command set.

I. INTRODUCTION

This project to design a prototype to control the solenoid valve using IoT. This particular concept can be implemented to control the valve of coffee maker using IoT. The Internet of Things (IoT) is the network of physical objects or things embedded with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data. The coffee makers which consist of closed valve are used to block the coffee. When some mechanical force acts on the valve it automatically open and it dispatches the coffee. This is the basic mechanism coffee maker's valve. In this application, when there is a need of coffee the command is send through the SMS and based on the command the valve of coffee maker will open and close and it dispatches the coffee. The system is SMS based and uses wireless technology to revolutionize the standards of living. This system provides ideal solution to the problems faced by home owners in daily life. In addition the application was a need to automate valve of coffee maker so that user can take advantage of the technological advancement in such a way that a person getting off the office and ready to serve the coffee. This type of remote control capability and possibility of achieving at a reasonably low cost. The main motto of the project is to make use of the GSM technology and also arduino microcontroller based embedded system to make a smart kitchen.

II. SYSTEM ARCHITECTURE

As shown in FIG1 the valve control is discussed in this paper is built on the SMS of the GSM network. In this system the main components are GSM modem and arduino microcontroller both are IoT devices. A text message is sent by the user through the GSM network. The GSM receiver which receives the messages and sends to the arduino microcontroller. All the devices are connected to the central control system of arduino microcontroller. The MAX232 is an integrated circuit which can be used to convert the TTL logic level to RS232 logic level. The microcontroller analyzes the command and instructs the relay. Based on that relay operates the solenoid valve.

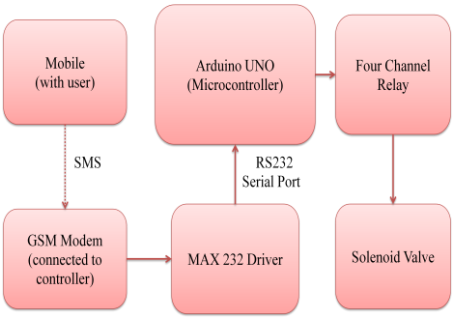

Fig1: System Architecture

III. WORKING PRINCIPLE

The process of controlling a valve will proceed through the following: Assume that the equipments are fed with electric current and operating properly. Initially the user sends the command through the SMS from mobile phone to GSM modem. GSM modem is connected to Arduino microcontroller via RS232 serial port connection. The MAX232 Driver can be used to convert the TTL logic into RS232 level logic. Because of GSM and microcontroller which only understood the machine language. Microcontroller keeps polling to check if the modem has received any text message. When the GSM receiver receives the message it will sends to microcontroller. GSM modem and arduino microcontroller can communicate through AT COMMANDS. It is a special type of command. It is an abbreviation of Attention Command. Microcontroller sends another command to the GSM modem to delete the current SMS for process the next SMS. Finally microcontroller analyzes the command and instructs the relay to switch ON/OFF. According to that relay operates the solenoid valve.

IV. COMPONENTS USED

- Microcontroller- Arduino UNO
- Solenoid Valve (12v)
- Four channel relay board (5v)
- Power supply (12v)
- RS 232 Serial Port
- MAX 232 Transceiver
- GSM Modem

The detail description of individual modules in the system is as follows.

A. Microcontroller

The Duemilanove board features an Atmel ATmega328 microcontroller operating at 5 V with 2 Kb of RAM, 32 Kb of flash memory for storing programs and 1 Kb of EEPROM for storing parameters. The board has 14 digital I/O pins and 6 analog input pins. It is a single chip microcomputer and it has a processing unit, memory, input output devices, timers, data convertors, serial port etc. It works with 32 × 8 general purpose working registers. The open-source Arduino UNO environment makes it easy to write code and upload it to the I/O board. It runs on Windows, Mac OS X, and Linux.

B. Solenoid Valve

It is an electromechanically operated valve. This valve is controlled by an electric current through a solenoid. Solenoid valves are the most frequently used to control fluids. This is a two ways device which performs two operations namely Normally Open (NO) and Normally Close (NC). It has one inlet and one outlet which normally permits or close the stream of liquid. It offers fast and safe switching, high reliability, long service life & good compatibility with any fluids. If the valve is open when the solenoid is energized, then the valve is termed normally open (N.O.). Similarly, if the valve is closed when the solenoid is not energized, then the valve is termed normally closed.

C. Four Channel Relay Board

A relay is an electrically operated switch. A relay is an electrical switch that opens and closes under the control of an alternate electrical circuit. In this prototype relay is used to allow low power circuit to switch a relatively high current on or off, and to control signals. Here the relay coil is designed to operate on 12V supply voltage.

D. Power Supply

All electronic circuits works only in low DC voltage, so it need a power supply unit to provide the appropriate voltage supply for their proper functioning .This unit consists of transformer, rectifier, filter & regulator. AC voltage of typically 230volts rms is connected to a transformer voltage down to the level to the desired ac voltage. A diode rectifier that provides the full wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation .

E. Rs232 Serial Port

GSM modem is connected to Arduino microcontroller via RS232 serial port connection. In RS232, a 1 is represented by -3 to -25V, while a 0 bit is +3 to +25V, making -3 to +3 undefined. For this reason, to connect

any RS232 to a microcontroller system. It must use voltage converters such as MAX232 to convert the TTL logic levels to the RS232 voltage level, and vice versa.

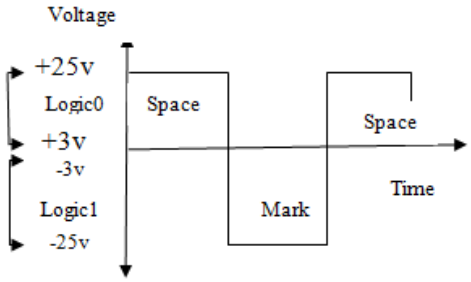

Fig 2: Rs232 Voltage Level

F. Max232 Driver

The MAX232 from Maxim was the first IC which in one package contains the necessary drivers (two) and receivers (also two), to adapt the TTL logic to RS232 signal voltage levels. It became popular, because it just needs one voltage (+5V) and generates the necessary RS-232 voltage levels (approx. -10V and +10V) internally.

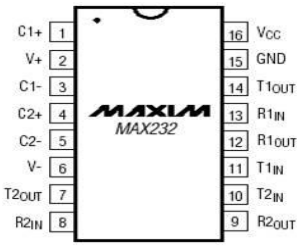

Fig 3: Pin Diagram For Max232 Driver

G. Gsm Modem

The Global System for Mobile Communications (GSM) is designed for global market, SIM300 is a Tri-band GSM/GPRS engine that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS1900 MHz With a tiny configuration of 40mm x 33mm x 2.85 mm, SIM300 can fit almost all the space requirement in application, such as smart phone, PDA phone and other mobile device. The physical interface to the mobile application is made through a 60 pins board-to-board connector, which provides all hardware interfaces between the module and customers' boards except the radio frequency (RF) antenna interface. This can be easily configured by AT command. The SIM300 is designed with power saving technique, the current consumption too as low as 2.5mA in sleep mode. The SIM300 is integrated with the TCP/IP protocol, extended TCP/IP AT commands are developed for customers to use the TCP/IP protocol easily which is very useful for those data transfer applications.

H. At Command Set

The GSM modem is connected to Arduino microcontroller via RS232 serial port connection. They communicate with AT commands. AT commands are a special set of commands that has been standardized to control and communicate with terminal equipments such as modem, mobile phone. Most of the GSM modems are support AT commands.
The following commands are used in this project,

SI.NO	COMMANDS	DESCRIPTION
1	AT+CMGS	To send a short message
2	AT+CMGR	To read a short message from the GSM module
3	AT+CMGL	To list SMS short messages stored in the GSM
4	AT+CMGD	To delete a short message from the GSM modem
5	AT+CNMI	Remind mode Setup when receive a new SMS

Table-I

AT-Attention

V. EXPERIMENTAL SETUP

The experimental setup shown in FIG 4 includes the Arduino microcontroller as shown in FIG 4(a) is connected to the relay board in FIG 4(b) acts as a control switch. The relay board is connected to the solenoid valve as shown in FIG 4 (d).

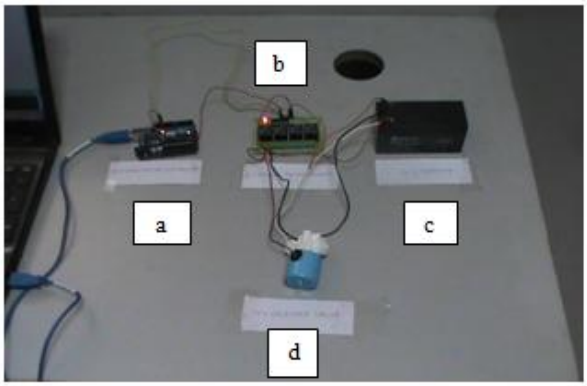

Fig 4. Experimental Setup
(a) Arduino Microcontroller, (b) Relay board, (c) Power Supply and (d) Solenoid Valve.

VI. EXPERIMENTAL RESULTS

The proposed system is designed for controlling of solenoid valve by using single GSM shown in FIG 4. Initially, the user uploaded the instruction to microcontroller. The microcontroller was powered to make it on. An SMS is sent from user mobile phone to GSM modem. The microcontroller received and read the SMS with the help of some predefined AT command set that was provided by the user to the microcontroller earlier. The Microcontroller crops the command text part of the SMS and sends another command to the modem to delete the current SMS for process next SMS. The microcontroller analyses the command and instruct the relay to switch ON or OFF and also based on it relay operates solenoid valve. The result shows that, it works well for controlling of solenoid valve at a time and also the user receives the feedback status immediately as well. The logic for relay and valve operation is given in Table II .

Logic For The Relay And Valve Operation

VOLTAGE LEVEL	RELAY STATUS	VALVE STATUS
HIGH (1)	ON	OPEN
LOW (0)	OFF	CLOSE

Table-II

VII. CONCLUSION

The approach discussed in the paper has achieved the target to control the solenoid valve remotely using the GSM -based system. The valve used to control the flow of fluids. In the existing coffee maker, it needs manual interaction to access that. In this application, when there is a need of coffee the command is send through the SMS and based on the command the valve of coffee maker will open and close and also it dispatches the coffee. The GSM coffee maker is much sophisticated for user. After the desired operation is performed the system provides the acknowledgement to the user. A SMS service is generally cheap and is a viable option for other remote connection options like internet. The proposed system saves time and effort.

ACKNOWLEDGEMENT

Authors thanks The Principal, Velammal college of Engineering a and Technology for providing the facilities in carrying out this project work.

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