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Implementation on Irrigation Water Pump Control System based on DTMF Technology

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ABSTRACT

Technology advancements made it possible for humans to simplify their work while still doing it with less labour- intensive methods. Better outcomes in less time. This project involves look forward to employing telephonic signalling Dual-tone, multi-frequency control method different electrical loads, including irrigation water pumps located in difficult-to-reach places. The current study is based on the idea that a Dual Tone Multi-Frequency (DTMF) signal can be used to turn on and off specified electrical loads. In the fields where we grow crops spaced out from one another, the tube wells operating them becomes. A person is forced to run from one location to another run the loads. Similar events occur in our homes as well. While keeping this in mind, a system developed to make the farmer's life easier as in addition to saving time by using DTMF technology remotely control the loads.

Keywords: DTMF, Controller, Load, Motor, GSM.

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I. INTRODUCTION

Introducing the DTMF Based Irrigation Water Pump Control System: a smart solution to manage irrigation using just your mobile phone! This system utilizes Dual-Tone Multi-Frequency (DTMF) technology, the same tones you hear when pressing keys on your phone, to control the water pump. With this setup, farmers can conveniently operate their irrigation systems remotely, without needing to be physically present at the site.

Here's how it works: By dialing a specific phone number and pressing certain keys on their phone, farmers can activate or deactivate the water pump. Each key press sends a unique DTMF tone, which is decoded by a receiver connected to the pump control system. This system offers flexibility and ease of use, allowing farmers to efficiently manage water distribution to their fields from anywhere, simply using their mobile phones.

By integrating technology with agriculture, this system aims to streamline irrigation processes, conserve water, and improve overall crop yield, empowering farmers with greater control and convenience in Managing their fields

The basic idea behind this project is to control the functioning of the agricultural load using wireless technology. In this project we will have two cell phones; one will be handed to the farmer which can send the digital signal to other mobile phone which is normally held in automatic answering mode at the load ends. At the receiving ends cell phone codes are inputs to the microcontroller, which pre-programmed to identify the command signal coming from the users ends, which is interfaced through relays & relay drivers according to the desired commands from users end. The cell phones at load site are usually DTMF decoded. DTMF will decode the keywords coming from user's site into digital codes of corresponding frequency which finally fed as input to the microcontroller. This gives farmers an ability to press the keypad of the cellphone and can switch on or off the water pumps installed at different positions of the land as per the desired of the farmers. A DTMF decoder & controlling circuit receives the input commands and control the on–off mode of the connected electrical motor pump. This circuit

designed is easily available using the various electrical and electronics circuit components. This act as a sign of relief for the areas which comes under draught region, where there is scarcity of rain water such as in Rajasthan. In such areas, a farmer can make better use of limited water and controlling based on weather conditions, environmental conditions. This also helps in water harvesting as water is utilized and not wasted. 3

To turn basic the idea of automatic irrigation water pump into realistic state hardware circuit along with software programming is required. The major hardware components used. Here we control irrigation water pump using mobile phone through DTMF technology. DTMF have provision with audio jack. Mobile phone connected to DTMF audio jack. Any key pressed in dial pad then it converts into DTMF tone. DTMF tones converts into 4 bit number format. By pressing keys in dial pad pump motor will be ON and OFF. Motor status will display on 16X2 LCD display.

II. METHODOLOGY

The methodology of a DTMF-based irrigation water pump control system typically involves several key steps. Firstly, the system requires hardware components including a DTMF decoder, microcontroller or microprocessor unit, and interface circuitry to connect to the water pump motor. The DTMF decoder is responsible for interpreting the tones generated by a phone keypad or a DTMF generator.

These tones are then processed by the microcontroller, which executes the corresponding commands based on the received DTMF signals. The interface circuitry facilitates the communication between the microcontroller and the water pump motor, enabling the activation, deactivation, and possibly other control functionalities. Secondly, the software aspect of the system involves programming the microcontroller to interpret the decoded DTMF signals and control the operation of the water pump accordingly. This programming typically includes functions to start, stop, and possibly adjust the speed or duration of irrigation cycles based on the user's input via the DTMF tones.

The receiving cell phone codes are converted into digital commands by using a DTMF Decoder which will identify the frequency of the key and convert that frequency to its equivalent digital code which is then fed to a microcontroller (8051 family). As per the commands sent from the sender’s mobile, the microcontroller will send signals through a buffer to actuate the respective loads by turning the relays ON/OFF. These relays are actuated by a relay driver IC interfaced to the microcontroller. Further this project can be enhanced by using a GSM modem.

III. BLOCK DIAGRAM

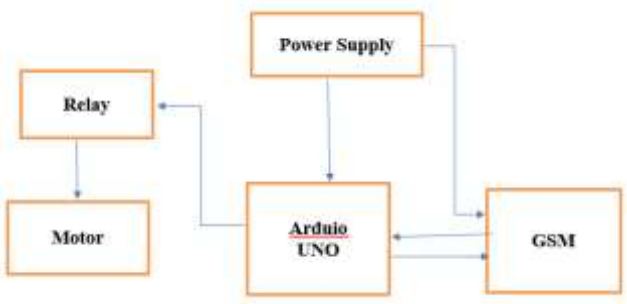

Fig 1. Block Diagram

A DTMF (Dual Tone Multi-Frequency) based irrigation water pump control system utilizes the tones generated by a telephone keypad to remotely operate the water pump. This system typically consists of two main components: the control unit and the DTMF decoder. The control unit is connected to both the water pump and a telephone line. When a user dials the designated phone number associated with the irrigation system and inputs the appropriate DTMF tones using their phone's keypad, these tones are transmitted through the telephone line to the control unit. The DTMF decoder within the control unit then interprets these tones and triggers the corresponding actions, such as turning the water pump on or off, based on the predefined instructions.

This technology offers a convenient and efficient way to manage irrigation systems remotely, allowing farmers or operators to control water pumps from a distance, reducing the need for manual intervention. Additionally, by leveraging existing telephone infrastructure, DTMF-based irrigation water pump control systems can be implemented in areas with limited internet connectivity, making them accessible to a broader range of users. However, it's essential to ensure the security and reliability of the system to prevent unauthorized access or interference with the irrigation process.

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IV. HARDWARE COMPONENTS

1.GSM MODULE:

A GSM module is a device that allows electronic devices to communicate with each other overthe GSM network. GSM is a standard for digital cellular communications, which means that it provides a platform for mobile devices to communicate with each other wirelessly.

A customised Global System for Mobile communication (GSM) module is designed for wireless radiation monitoring through Short Messaging Service (SMS). This module is able to receive serial data from radiation monitoring devices

such as survey meter or area monitor and transmit the data as text SMS to a host server. It provides two-way communication for data transmission, status query, and configuration setup. The module hardware consists of GSM module, voltage level shifter, SIM circuit and Atmega328P microcontroller. Microcontroller provides control for sending, receiving and AT command processing to GSM module. The firmware is responsible to handle task related to communication between device and host server. It process all incoming SMS, extract, and store new configuration from Host, transmits alert/notification SMS when the radiation data reach/exceed threshold value, and transmits SMS data at every fixed interval according to configuration. Integration of this module with radiation survey/monitoring device will create mobile and wireless radiation monitoring system with prompt emergency alert at high-level radiation.

Fig: 4.1 GSM Module

2.Relay

Fig: 4.2 Relay

Relay is one kind of electro- mechanical component that functions as a switch. The relay coil is energized by DC so that contact switches can be opened or closed. A single channel 5V relay module generally includes a coil, and two contacts like normally open (NO) and normally closed (NC). This article discusses an overview of the 5V relay module & it's working but before going to discuss what is relay module is, first we have to know what is relay and its pin configuration.

3.Aurdino uno

Aurdinouno, often shortened to "Arduino," is an open-source electronics platform that combines both hardware and software.

It is designed for creating interactive electronic projects, allowing users to write and upload code to a microcontroller. The platform is accessible to both beginners and experienced engineers due to its user-friendly IDE (Integrated Development Environment).

Arduino boards are based on different microcontrollers, such as the ATmega328, offering a range of functionalities and performance capabilities.

Common Arduino boards include the Uno, Mega, and Nano, each suited for different types of projects.

Arduino projects often involve sensors, actuators, LEDs, and other electronic components to build interactive systems.

The open-source nature of Arduino encourages community collaboration, with a vast ecosystem of libraries, tutorials, and projects available.

Arduino is widely used in education, prototyping, DIY electronics, and IoT (Internet of Things) applications.

Fig 4.3 Controller

4.Buck converter

A buck converter is a type of DC-DC power converter that steps down voltage while increasing current. It's widely used in electronics to efficiently regulate voltage levels. The converter operates by switching a transistor on and off to control the flow of current through an inductor and capacitor. Buck converters are commonly found in battery-powered devices and power supplies. They are favored for their high efficiency and small size compared to linear regulators.

Fig: 4.5 Buck converter

5. Pump Motor

A 5V pump motor is a type of electric motor designed to operate on a 5- volt power supply. These motors are commonly used in small-scale projects and devices such as water pumps, aquarium equipment, and mini air pumps. They typically offer low power consumption and are suitable for applications where space and energy efficiency

are important. When selecting a 5V pump motor, it's essential to consider factors such as flow rate, pressure capability, and compatibility with the intended power source and control circuitry.

Fig 4.6 5v pump motor

5.**Wires**

Fig 4.7. Wire

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V. ADVANTAGES

1. Remote Control: DTMF allows for remote control of the irrigation water pump system, enabling farmers or users to operate the pump from a distance. This is particularly useful in large agricultural fields where manual operation may be inconvenient or time-consuming.

2. Simple Interface: DTMF technology utilizes phone keypads for control, making it intuitive and easy to use. Users can simply dial the designated phone number and input commands using their phone's keypad, eliminating the need for complex interfaces or training.

3.Cost-Effective: Implementing a DTMF based control system is generally cost-effective compared to more advanced remote control technologies. It leverages existing infrastructure such as telephone networks, reducing the need for additional hardware or communication systems.

4.Reliability: DTMF signals are robust and reliable, ensuring consistent communication between the control unit and the water pump system. This reliability is crucial in agricultural applications where consistent watering schedules are necessary for crop health.

VI. HARDWARE SETUP

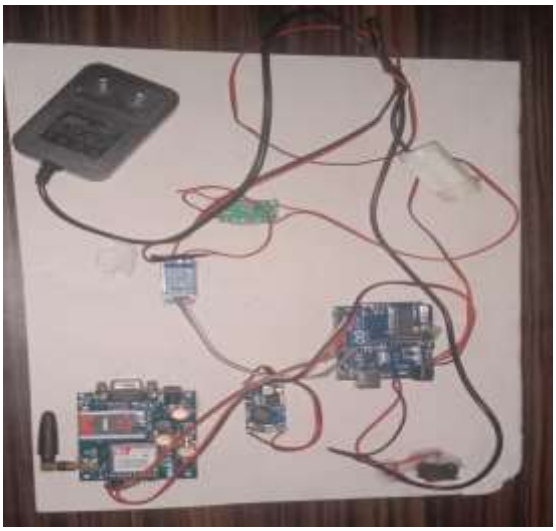

Fig 4.8. Hardware Setup

VII.CONCLUSION

The DTMF-based irrigation water pump control system offers a solution to the challenges of manual pump control in farming. By enabling remote operation and scheduling, it improves efficiency and resource management. This technology promotes water-efficient agriculture and addresses the needs of farmers in both developed and remote areas. Overall, it revolutionizes irrigation practices, leading to better crop yields and sustainable farming. In conclusion, the DTMF-based irrigation water pump control system offers a solution to the challenges of manual pump control in farming. By allowing remote operation and scheduling, it improves efficiency and crop yields. This technology is especially valuable in remote areas with limited infrastructure, where it can revolutionize agricultural practices and promote sustainable water management, ultimately enhancing food security and farmer livelihoods.

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