Smart Switching ON/OFF of Motors in Agricultural Fields through SMS

Mr. R.V.L.N Divakar* ,Manohar Sanapathi# , Bandaru Bhaskar Rao#,

Annepu Gayatri#, Surampudi Jigenesh# , Nandikola Abhishek#

** Assistant Professor,Dept. of EEE, Anil Neerukonda Institute of Technology and Sciences, Visakhapatnam, India*

#B.Tech Student EEE, Anil Neerukonda Institute of Technology and Sciences, Visakhapatnam, India

Abstract

This project aims to facilitate owners' operation of agricultural water pumping equipment. The existing control system for the water pump machine in the agricultural field still has several restrictions because it can only be managed by sending an SMS(*Short service message*). An apparatus in the water machine control system that can control missed calls and receive status updates via SMS led to the development of the Arduino UNO(*mean One in Italian language*) microcontroller technology, which allows the reading of the GSM(*Global System for Mobile Communication)* Module and communication to an SMS gateway. The SMS Gateway can be operated remotely using cell phones as well as by inputting texts. When a water machine is manually turned on or off, the owner receives information automatically updating them on its state. The data is also transmitted to an Arduino UNO microcontroller if the water machine is manually switched off. The Arduino UNO microcontroller is used to turn on and off the water machine via a wireless communication channel that is created by using a smartphone and missed calls. SMS notifications are sent to the Arduino UNO controller with status updates. The experiment's conclusions facilitate real-time water control and simplify the owner's task of controlling the motors in the agricultural field.

Keywords- GSM module, Arduino UNO controller, Motor, Prototype

1. INTRODUCTION

Since agriculture is the main source of nutrition and without it, life would not be possible, it is the foundation of the Indian economy. However, low income and a lack of labour for agricultural work are two issues that farmers frequently deal with. Because of this, automation is becoming more and more necessary in the agriculture industry to improve productivity and streamline procedures. The system's use of microchips enables simplified programming, which makes it easier to carry out particular jobs efficiently. The central component of this framework is embedded PC systems, which are composed of microcomputers running certain applications and provide fixed features that are difficult to change.[1][2] The design of these systems heavily weighs energy and cost concerns, with an emphasis on cutting costs and maximizing energy use. Despite their restricted memory and possibly slower processing speeds, embedded systems provide affordable agricultural automation options. Relays and AC(alternative current) water pump motors are examples of hardware components that are integral to the system's design and enable its operation. Hardware and software integration is necessary to guarantee that the system works well and produces the intended outcomes.[8]

In conclusion, the project's goal is to use automation technology to transform agricultural methods to improve production in the industry and solve the problems that farmers confront.

2. OVERVIEW OF SMS CONTROL MOTOR

With the use of missed calls from a cell phone, the system that is being presented is the irrigation pump. The Arduino Uno board, GSM module, relay, and LCD(Liquid crystal-display) panel are the main parts of the system. Farmers may efficiently manage their irrigation systems and free up time for other duties by putting this method into place and saving time and effort.[6][7] Using missed calls from a cell phone, the system under description has been designed to remotely monitor and control a submersible pump, allowing for automatic on and off operation. Furthermore, messages are used by users to get status updates. The controller for this device, which governs the irrigation pump, is a cell phone. Farmers may organize their time to other duties while efficiently controlling their irrigation systems by putting this strategy into place, which will save them time and effort.[1][2][3]

Operating:

In the system outlined, a motor pump for irrigation is controlled by an Arduino board that is linked to a GSM modem. The setup and operation can be summed up as follows:

Hardware Configuration:

GSM modem and Arduino board connected: The GSM modem's receiver and the Arduino board's transmitter are linked, and vice versa. The two gadgets can now communicate with each other thanks to this. [7][6]

Relay connected to motor pump: The Arduino board's digital pins operate the relay, which is linked to the motor pump.[4][5]

LCD linked to Arduino: To display the water pump's state, the LCD is linked to the Arduino's digital pins.[11][10]

Power supply: A 12V supply via an adapter powers the GSM modem, while a 5V supply from a USB(Universal serial bus) connection powers the Arduino board. Indicating that the GSM/GPRS module is powered on is a red light indicator.[3][4]

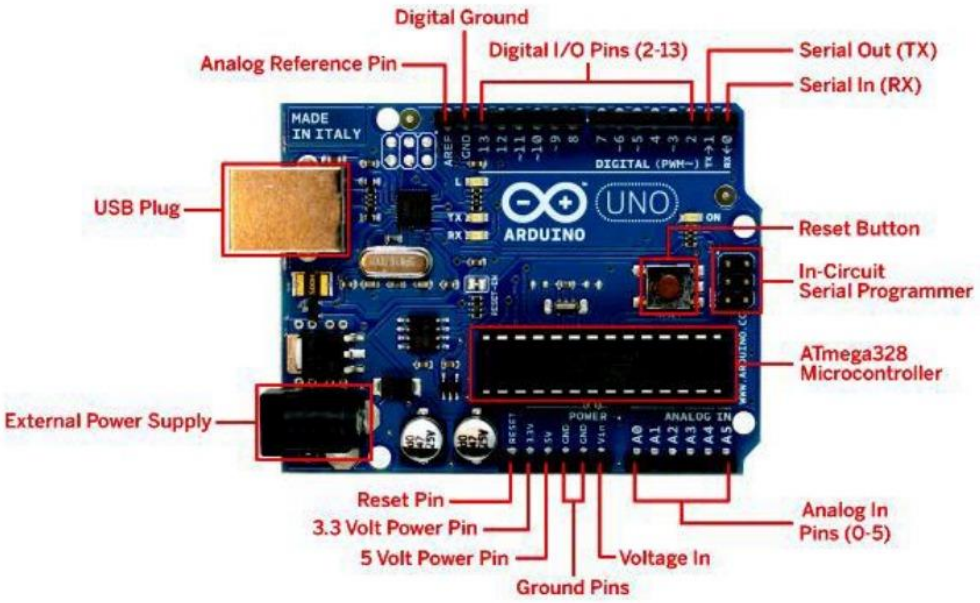
How it works:

Remote control with phone calls and messages: The Arduino gets a signal from the farmer calling the number linked to the GSM modem, which activates the relay and turns on the motor pump. The user receives an SMS alert verifying the activation of the pump.[9][4]

Switching off the pump: To switch off the motor pump, the user can send a message. The Arduino turns off the water pump by setting the relay output low after getting this message.

ArduinoUNOR3: The Arduino Uno R3 is a microcontroller that operates at Mega 328 and is panel dependent. It operates at +5V of electricity. It consists of 14 computerized I/O points, six of which are stretch PWM harvests, a 16 MHz functioning clock, a USB indication, six modest information bases, a power key, and finally a rearrangement key. With the Arduino IDE programming tool, the Arduino can be customized using C or C++.[11][4]

Figure 4.1 : Arduino UNOR3



The Arduino UNO is a microcontroller board that includes six analogue inputs, a 16 MHz ceramic resonator, six digital input/output pins (six of which can be used as PWM outputs), a USB port, a power jack, an ICSP header, and a reset button. It comes with everything required to support the microcontroller; all you need to do is power it with a battery or an AC-to-DC adapter or connect it to a computer via a USB cable to get going.[4]

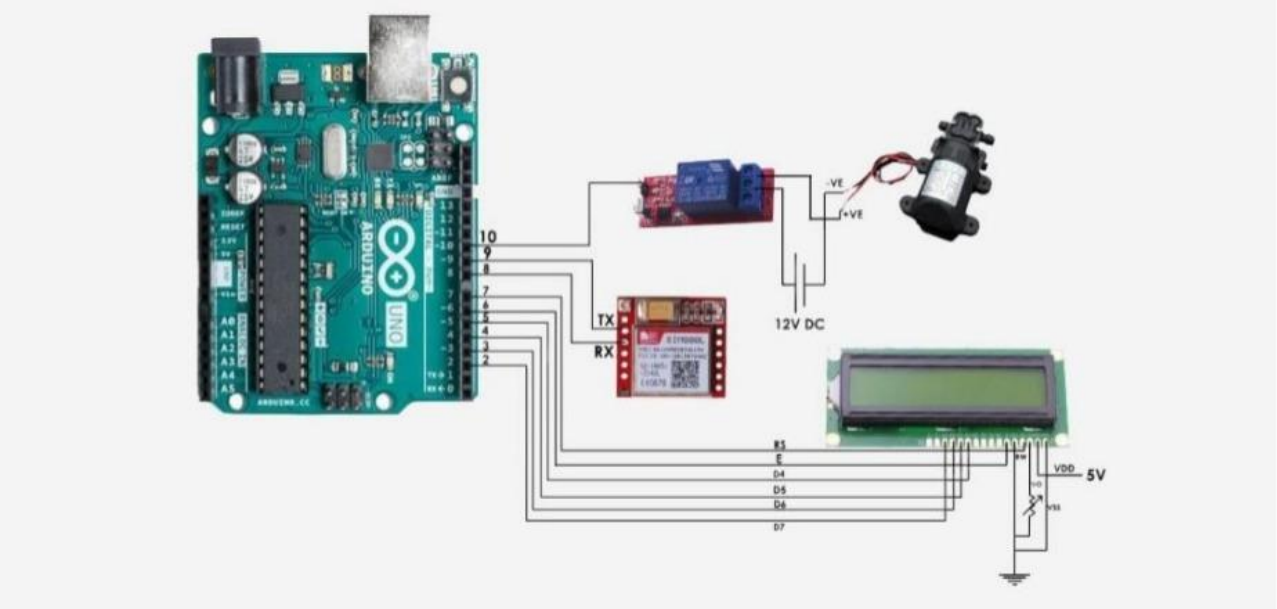
GSM SIM 900A-MODULE : The SIM900A is a tiny cellular module that supports voice calls, SMS sending and receiving, and GPRS transmission. It is capable of performing simple phone activities, such as making calls and sending SMS. To function, the GSM requires a 5V power source. [7][8]

LCD DISPLAY: An LCD normally has two pins for the LED backlight and sixteen data pins in total. Character LCDs feature an interface consisting of 14 pins by default and 16 pins for those with backlights. Additionally, there might just be one backlight pin, connected to the other via the Ground or VCC pins. Pin 1 may come first among the two backlight pins.[4][5]

Fig 4.10 LCD display

SINGLE CHANNEL RELAY: Because of its internal design, the Single Pole Double Throw relay is particularly helpful in several situations. It features two contacts in two alternative configurations: normally closed and opened, or normally open and closed. It also has a single common terminal. Essentially, the SPDT relay functions as a means of switching between two circuits: one "receives" current while there is no voltage supplied to the coil, while the other circuit does not, and the opposite occurs when the coil is energized. [7][8][5]

HARDWARE IMPLEMENTATION:

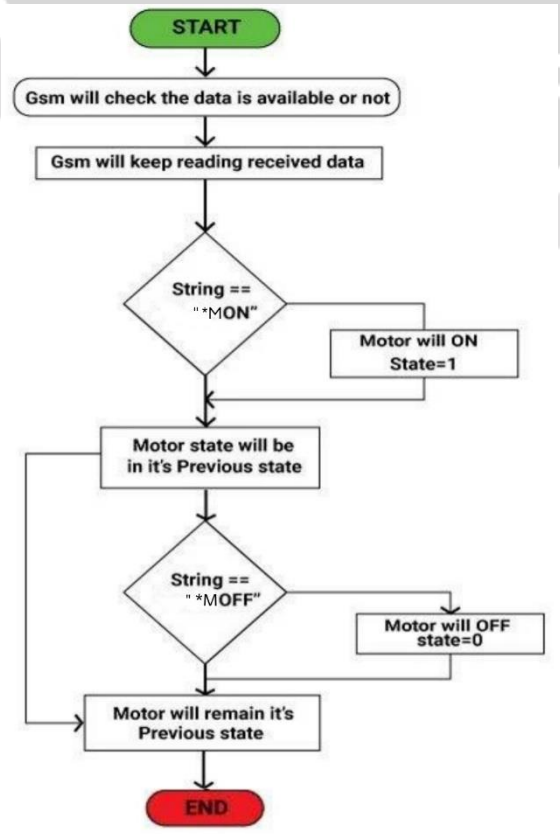


ALGORITHM PROPOSED:

Programming with the Arduino IDE: C is the programming language used to program the Arduino UNO R3.

Determining the motor's pinouts, verifying incoming data from the GSM modem, and managing the relay in response to orders are examples of functionality.

Flow diagram:



The system's intricate operation is depicted in a flowchart, which outlines the steps involved in executing commands and managing the motor pump.

3. PROCEDURE OF OPERATION:

The GSM modem transfers the message signal to the Arduino, which then triggers the relay to activate the pump when the farmer sends a message to turn on the motor pump.

Likewise, if a signal is sent to stop the pump, the relay output is lowered, which stops the pump. All things considered, this method offers farmers a practical and effective way to use their cell phones to remotely control irrigation systems. Microprocessors are integrated into embedded systems, which are crucial parts of contemporary electronic gadgets that improve flexibility and simplify system design. Without the variety of general-purpose computers, these systems are designed to do specific tasks using specialized software integrated into the hardware. Embedded systems are ubiquitous, with millions of microchips produced every week to power a wide range of commonplace goods.

Embedded system designers use specialized software tools and programming languages to create and manage complex hardware systems. They have extensive knowledge of these technologies. Because of the importance of these technologies in particular industries, companies provide tools and kits for embedded systems development that are specifically designed for engineers and enterprises.

Embedded systems have unique properties, particularly in terms of price and power usage. The adoption of slower CPUs and smaller memory sizes, frequently with simplified designs to decrease expenses, is driven by cost reduction. These systems often use alternatives like flash drives and LCD panels in place of more conventional peripherals like disk drives and operating systems.

In embedded systems, reliability is critical. Firmware is carefully designed and tested to guarantee uninterrupted functioning over long periods. For certain applications, different CPU architectures—including system-on-a-chip versions—are used. The development process is aided by software tools such as compilers, assemblers, and debuggers, which are frequently modified versions of GNU software development tools or acquired from specialized businesses. To handle data conversion and guarantee software integrity using checksums or CRC checks, developers utilize utility programs. Depending on the needs of the application, embedded systems can have real-time operating systems, specialized embedded systems, or none at all. To properly identify problems, debugging is usually carried out using in-circuit emulators or debuggers, with a focus on high-level language debugging and basic logging tools.

Embedded systems' control loop structure is based on a basic loop that calls subroutines to control software or hardware. Real-time event handling is mostly dependent on interrupts, whereas state machines and timers effectively control system behaviour. Even though this method is dependable and simple, it could be difficult to add new features and maintain consistent timing. On the other hand, it ensures that the software will run continuously without requiring sophisticated operating system.

Components labelling:

Sl.no	Component name	Specifications
1.	Arduino UNOR3	5V,16MHZ clock speed
2.	GSM SIM 900A-module	3.4-4.5V,Buad-rate:1200 to 115200 bps
3.	Single channel relay	5V DC, no .of channels-1
4.	LCD display	4.5-5.5V,supply current-2mA
5.	Power supply	12V

Instructions for user to send to GSM module:

Sl.no	Operation	SMS from Phone
1.	To turn on the motor	*MON

2.	To turn off the motor	*MOFF

Block diagram of prototype:

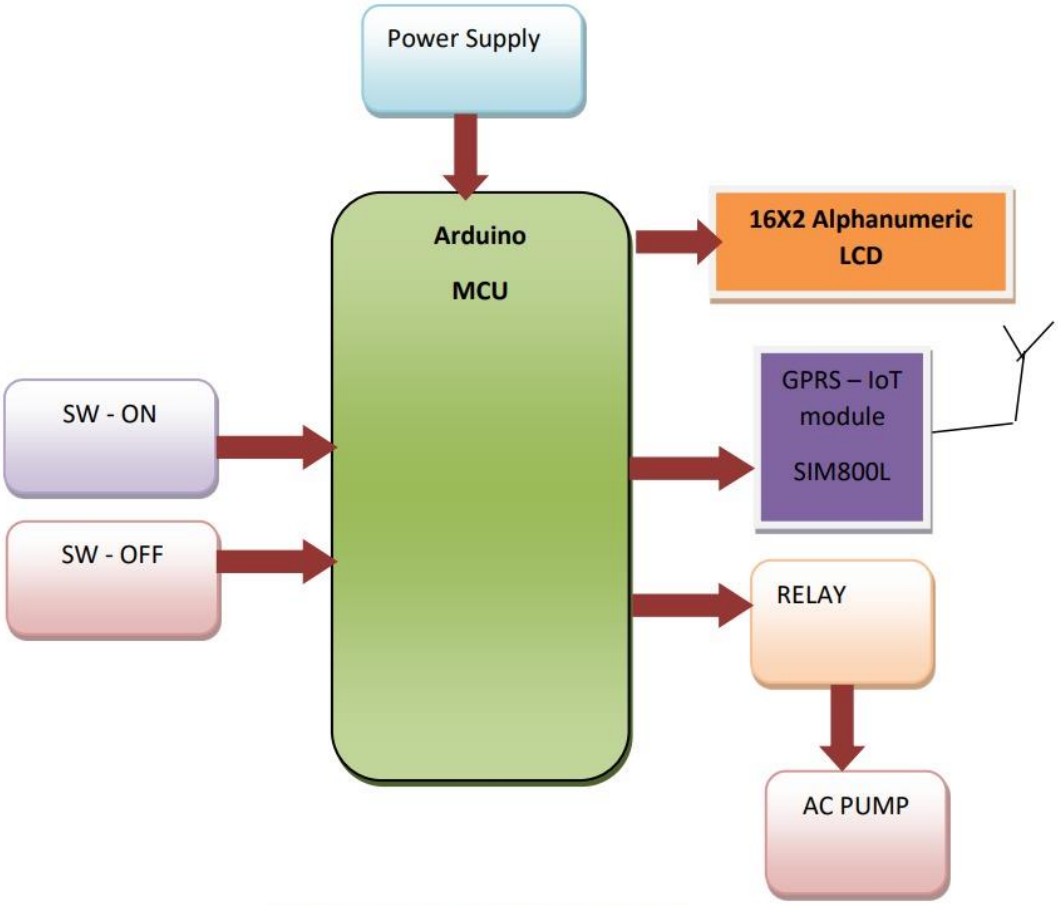


Figure 3.1: Block diagram of prototype

4. RESULT AND DISCUSSION

The prototype of the control system, centred around the Arduino UNO, demonstrates successful experimentation and functionality. By utilizing the GSM SIM900A module, the water pump can be remotely switched on and off by making phone calls. Upon successful activation or deactivation, notification messages are received, confirming the pump's status ("PUMP ON SUCCESS" or "PUMP OFF SUCCESS"). Upon sending default messages for turning on motor like *MON and *MOFF then motor state will be changed accordingly.

This prototype has been rigorously tested in agricultural fields, where the status of the water pump can be conveniently monitored and controlled using smartphones. The use of GSM networks enables communication over considerable distances, surpassing the limitations of Wi-Fi modules or Ethernet shields. Moreover, to ensure the security of communication, the system filters incoming SMS messages based on predetermined numbers, preventing unauthorized access or control.

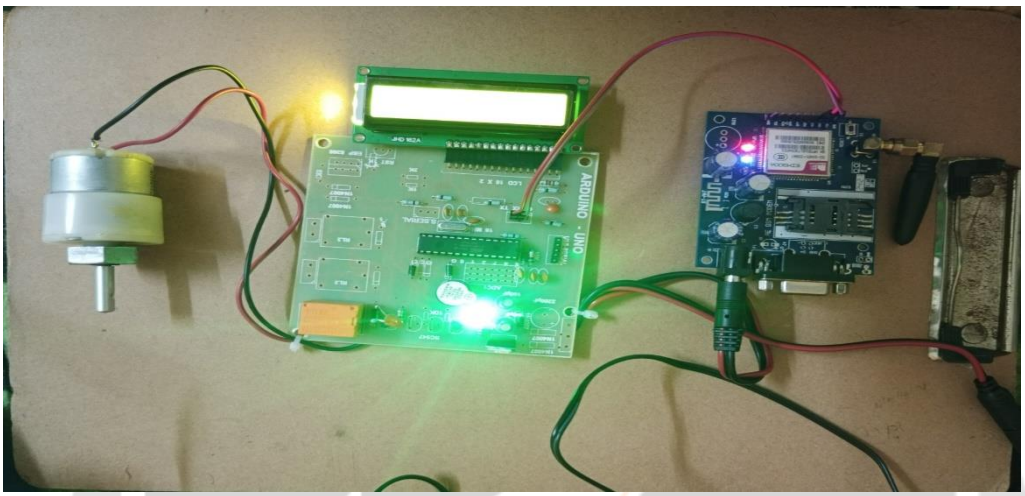
Overall, the successful experimentation and testing of this prototype validate its effectiveness in providing remote control and monitoring capabilities for water pumps in agricultural settings.

The discussion highlights the significance of the SMS-based remote control system for agricultural water pumps, particularly in coastal areas where canal water availability is limited to specific days, typically 2-3 days. In such scenarios, neighbouring farmers might inadvertently switch off water pumps if the owner is absent from the field.

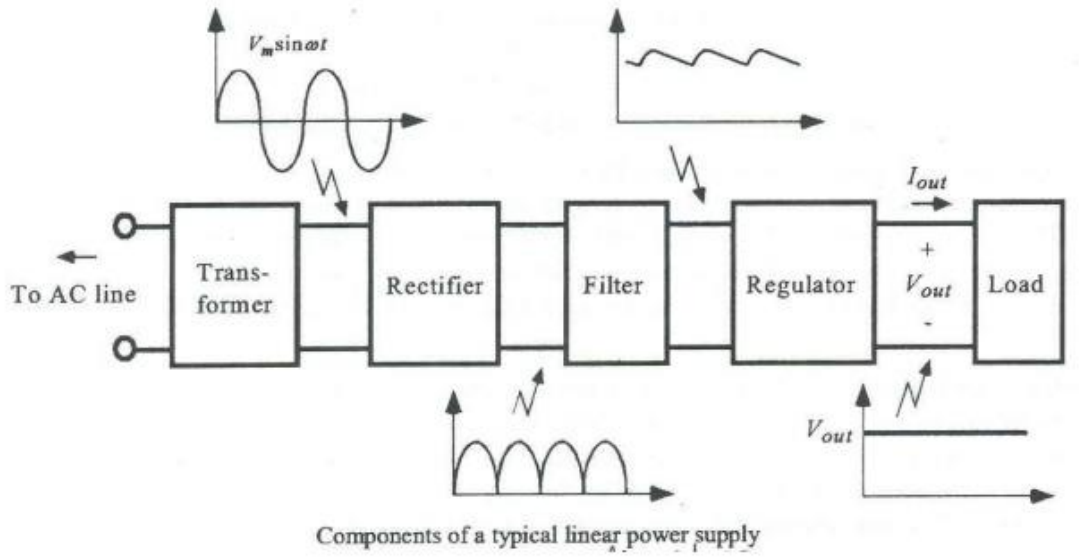
The implementation of SMS-based remote control and notification systems addresses these challenges effectively. Farmers can now remotely switch on and off their water pumps simply by making a phone call. Additionally, they receive status notifications through SMS, providing real-time updates on the pump's operation.

Importantly, in cases where the water pump is manually switched off by someone else, the farmer receives a notification confirming the manual intervention. This feature ensures that farmers are informed of any unexpected changes in pump status, allowing them to take appropriate action.

Overall, the SMS-based remote control system enhances operational efficiency and convenience for farmers, enabling them to effectively manage water pump operations even in situations where physically unavailable.



Circuit features with power supply:



Components of a typical linear power supply

Display status:

Sl.no	Display message	Description

1.	Finding module…..	System detects module
2.	Module connected….	Successful message after connecting module
3.	Disabling ECHO…	Disables ECHO
4.	ECHO OFF…	ECHO signals turned off
5.	Finding network….	System detects network
6.	Network found…	Successful message when network found in the GSM module
7.	System ready…	Confirmation that system is ready for operation
8.	*MON	Message received to GSM module for commanding to turn ON
9.	*MOFF	Message received to GSM module for commanding to turn OFF

5. CONCLUSION

The successful experiment conducted on the water pump control prototype signifies a significant advancement in agricultural technology. By utilizing a simple phone call to a designated number, farmers can seamlessly control the water pump without the need for typing and sending SMS messages, enhancing operational efficiency and convenience. Moreover, the system provides real-time status notifications via SMS, ensuring that farmers are promptly informed about the status of the water pump. If the pump is manually switched off, an automatic notification is sent, indicating that the pump has been turned off manually. Similarly, if the pump is manually switched on, the farmer receives an immediate notification confirming its activation.

This capability not only streamlines the monitoring process but also enables quick response and intervention in case of manual adjustments made by others. Overall, the success of this experiment highlights the potential of innovative technology to revolutionize agricultural practices, improving productivity and resource management in the fields.

6. FUTURE SCOPE

• At present, one water pump is controlled. In the future, we can

implement it to control two or more water pumps.

• We can implement it in the Aquaculture.

- Because of how long it takes to operate water machines now, especially when utilizing SMS to turn them on or off, this approach is considered inefficient. A water machine control system that uses an Arduino UNO microcontroller and a smartphone as the controller has been created in response to this problem.

This technology eliminates the latency that comes with SMS commands by enabling control through phone calls.[1][2]

- The suggested method makes it possible to monitor and remotely access the submersible pump, as well as to automatically turn it on and off using missed calls from a cell phone. Users can also receive notifications about their status via text. An Arduino Uno board, a GSM 800l module, an SPDT relay, a submersible pump, and a display screen are among the system's essential parts. By putting this system in place, users may more conveniently and efficiently manage and control water machines, which enhances the overall performance of irrigation systems.

- The outlined scope of the project encompasses addressing the inefficiencies in the current method of operating water machines, particularly focusing on the delay associated with using SMS commands. To mitigate this, the project proposes the development of a water machine control system utilizing an Arduino UNO microcontroller and a smartphone as the controller. By enabling control via phone calls, the system aims to eliminate the latency inherent in SMS commands.

- The proposed system not only allows for monitoring and remote access to the submersible pump but also facilitates automatic turn-on and turn-off functionality using missed calls from a cell phone. Additionally, users receive status notifications via text messages, enhancing convenience and ensuring timely updates. The key components of the system include an Arduino Uno board, a GSM 900A module, an SPDT relay, a submersible pump, and a display screen.[4][5]

- Furthermore, the project suggests potential future directions for expanding the system's capabilities. This includes implementing it to control two or more water pumps, thereby enhancing its applicability in scenarios requiring multiple pumps. Additionally, the system could be adapted for use in aquaculture, where precise control and monitoring of water systems are crucial for optimal aquatic life support.

In summary, the project aims to enhance the efficiency and effectiveness of water machine control in irrigation systems, with potential for further development and application in related fields such as aquaculture, ultimately contributing to improved resource management and productivity.

7. **REFERENCES**

1 . Kay, M. "Smallholder irrigation technology: Prospects for sub-Saharan Africa International Program for Technology and Research in Irrigation and Drainage, FAO, Rome, 2001, pp. 1-25.

2 . N. Shah and 1. Das, 'Precision Irrigation Sensor Network Based Irrigation, a book on Problems. Perspectives and Challenges of Agricultural Water Management, IIT Bombay, India, pp. 217-232, April 2008

3 . Fangmeler, D. D. Garrot. D. J. Mancino, C.F and Husman, S. H. "Automated irrigation systems using plant and soil sensors, American Society of Agricultural Engineers, ASAE Publication, 1990, pp. 533-537.

4 Benzeki, A., Meghriche, K., and Refoufi, L., PC-based automation of a multi-mode control for an irrigation system Proceedings of International symposium on industrial embedded systems, Lisbon, July 2007, pp. 310-315

5 . Shinghal, K., Noor, A., Srivastava, N., and Singh, R., Wireless sensor networks in agriculture for potato farming International Journal of Engineering, Science and Technology, Vol. 2. No. 8, 2010, pp. 3955-3963.

6 .156Gautam, L. and Reddy, S. R. N. Innovative GSM-Bluetooth based remote controlled embedded system for irrigation, International Journal of Computer Applications, Vol. 47, No. 8, 2012, pp. 1.

7. Zhang, F Yang, M., and Ying. H. The application of GSM communication agricultural automation, Journal of Technology for Agriculture, Vol. 1. No. 1. 2004, pp. 39-41.

8. Shen Jin, Song Jingling, Han Qiuyan, Wang Shengde, and YangYan, School of Electric and Electronic Engineering A Remote Measurement and Control System for Greenhouse Based on GSM-SMS, IEEE 8th International Conference 2007 pp. 45-82 Electronic Measurement and Instrument.

9 .Webin Huang, Guanglong Wang. Research of Wireless Sensor Networks. for an Intelligent Measurement System Based on ARM, pp. 1074-1079, 2011.

10. Sezen SM, Yazar A, Irrigation Management on Yield And Quality Of Tomatoes Grown in different Soilless Media in Glasshouse, 41-48, 2010. (11). Daniel K.Fisher and HinutKebede, a Low Cost Microcontroller-Based System to Monitor Crop Temperature and Water Status, pp. 168-173, 2010.