RF Communication based Wireless Industrial Control and Monitoring System

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***Abstract*—One of the most often used techniques in major companies is panel control instrumentation. Wires connect the instruments on the control panel, such as switches and monitors, to the CPU. With these cables, the processor sends measured variables to the control panel, and the control panel sends processed variables to the processor. During wet seasons, subterranean wiring can become clogged and cause data loss if not properly maintained. This could result in a faulty procedure. To get around this, radio frequency waves are employed to send the signal from the control panel to the processing plant. Personal computers are linked to level converters and RF transmitters in industrial control rooms. This research presents the design and implementation of a wireless RF-based industrial equipment control system. An electrical system can be powered by a button press, key turn or drawing the tiled rope on the body, depending on the industry.**

***Index Terms*— RF communication, Wireless Communication, Panel Control.**

I. Introduction

To eliminate data loss at the receiving end, wireless industrial process control is an ideal solution. RF-based industry control is well-documented in the literature [1], [2]. An industrial operation like a pump, blower, lights etc. can be wirelessly controlled. Wireless RF-based industrial equipment control system design and implementation are presented in this study. Depending on the industry, an electrical system can be powered by pressing a button, turning a key, or pulling a tiled rope across the body [2]–[4]. Frequently, operators have to walk a significant distance to turn on or off the system. The business owners are concerned when the service is necessary. This endeavor has been launched to help bridge the gap between the system and the operator. The operator can remotely turn on and off machines 100 meters distant from the building using a 435MHz radio frequency [5]–[7]. The electrical apparatus can be controlled from a distance using a transmitter unit and an antenna. In order to turn the electricity on or off, the controller sends the signal to a relay, which functions as a switch. Before it's connected to the Monitoring system, this work will be double-checked for accuracy. The set-up includes an RF transmitter and receiver module, with the RF receiver coupled to the process components such as a pump and lights in the process area. As far as possible away from the process, the RF transmitter was linked with system in control room that was over 100 meters away from the process station.

II. Literature Review

Communication nodes in the Internet-of-Things (IoT) universe indicate single-purpose devices in one of the areas where they communicate with one another. Data from a large number of sensors is transmitted through a variety of network types until it reaches the data repository, which may be in the cloud. This communication is therefore protected at the point where the information is created, i.e., at the sensors' outputs (or inputs). This link must be protected at the point of information generation, which is within the sensors themselves, in order to be protected. The authors of [2] propose an algorithm for exchanging encryption keys in smart-home systems as a solution to the challenge of communication security in IoT networks. Smart devices connected to the Internet of Things (IoT) can be made more secure, as described in [3]. One of the most important categories to examine is one that collects sensitive and private data systems. This includes, for example, data from sensors that monitor the human body's essential statistics. A faster algorithm implementation using the 64- bit Intel AVX2 microcontroller architecture is provided in [4, where the authors claim that it is faster than the existing implementation using the SPECK/SIMON cypher. in the sphere of healthcare, cryptography methods have been examined for their appropriateness [5].

III. Mathematical Modeling and Methodology

Four hundred thirty-five megahertz (MHz) is the frequency used by the RF transmitter and receiver. At both ends of the transmission and reception radio signals communicate within the defined frequency range. When a user hits a button on the wireless remote at the transmitter unit, the controller picks up the signal and encodes it, after which it sends the encoded signal. The signal is captured by the receiver at the opposite end to take action. Below is diagrammatic concept about working of system as shown in Fig. 1. When it comes to designing an RF wireless communication-based system, there are a variety of options. The microcontroller architecture was used to construct a wireless transmitter-receiver interface, which was used to govern the communication between two units that were not identical.

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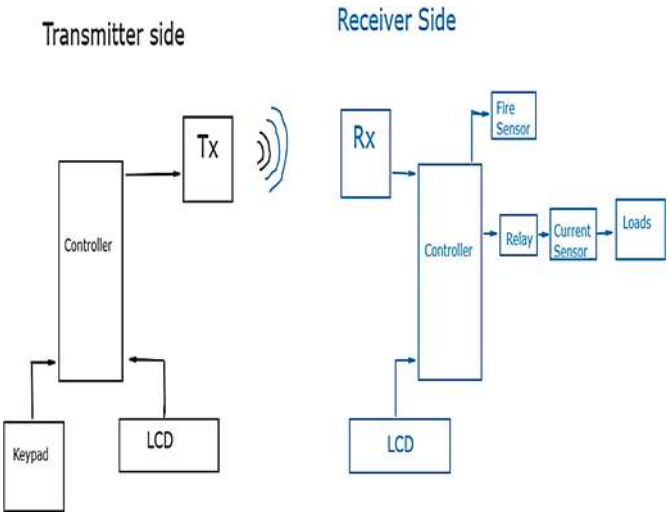

Fig. 1. Block Diagram.

As long as the transmitter and receiver are within a range of zero to one hundred meters, it is assumed that whatever is delivered to the transmitter will be received at the receiver (0-100m).

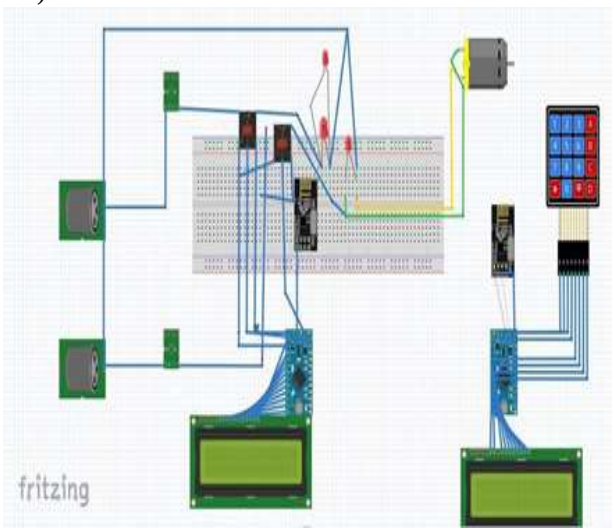

Fig. 2. Proposed Circuit Design on fritzing.

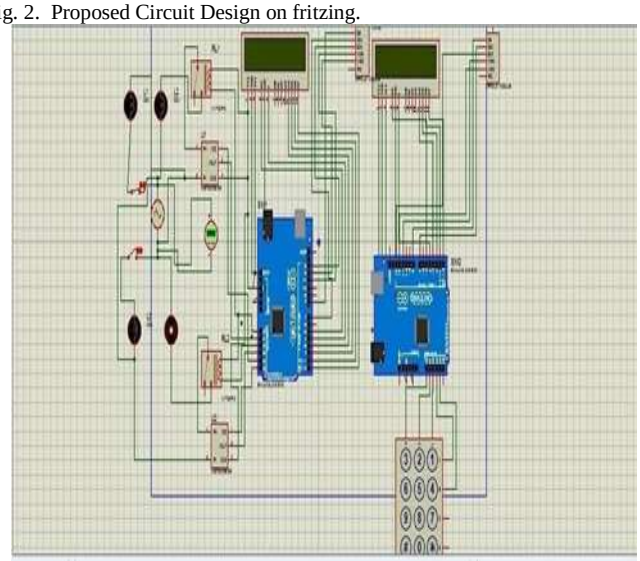
Fig. 3. Proposed Circuit Design on Proteus.

In order to work with the Arduino microcontroller interface, the system's transmission unit has been developed to function at a radio frequency of 435MHz. Even if the challenge of incompatibility is successful, data/signals will not be sent due to the noise that will be created. All four pins on the transmitter unit are used for transmitting data. One of these is a HIGH pin, one is a LOW pin. The data pin is linked to the signal peripheral designated by our microcontroller, while the power pins are all connected to their respective polarities. Transmission units are supplied with a voltage that permits them to function without any limitations. The greater the supply or input voltage provided to the transmitter, the longer the transmission is projected to endure (even if it is within its rated range).


Fig. 4: Transmitter Side

The receiver unit must be Arduino Uno compatible in order to connect with the Arduino Uno architecture. Receiving, analysing, and responding to data and signals received from the transmission unit are the responsibilities of the reception unit. In comparison to the transmitter, it just has three pins instead of four, which makes it easier to work with. The three pins provide power, ground, and data/signal transfer for the whole device. The RF receiver works in the opposite way from the RF emitter. Input data is sent from the transmitter to the controller unit, where it is processed and relays are triggered as needed.which are activated or deactivated depending on the current scenario.


Fig. 5: Receiver Side

IV. Conclusion

The project is being constructed with the goal of monitoring and regulating various sites. The sensors we employed for monitoring had a range of 20 to 30 meters and were comprised of a variety of light, temperature, and current sensors. Control is accomplished by the employment of various actuators that are triggered by the data obtained from the sensors. The user has the option of connecting to the server and exerting complete control over the location. The system's application field is broad because it can be readily deployed in any area, allowing us to monitor as many sites as we want at the same time. It can be installed in a home or in an office to provide us with a precise estimate of the quantity of energy that has been utilized. It also provides the capability of managing the amount of energy consumed from any location. It will also improve safety in a variety of industrial settings by allowing complete control over the temperature. Sensors and actuators can be customized for a variety of applications, including the monitoring of a mechanical system or any industrial robot or machine, among others. With this update, it can be used to monitor a large range of robots in order to ensure that they remain inside particular predetermined boundaries. If necessary, the actuators might be used to shut down the system in an instant. Furthermore, this information can be transferred to a central system. Previously, in [4], a similar application of this type was developed and implemented. Buildings that are more environmentally friendly and that have lower lighting and heating expenditures are examples of how similar applications might be used to benefit the environment.

V. Future Directions

The project is being built with the purpose of monitoring and regulating a number of different locations. The sensors we used for monitoring had a range of 20 to 30 meters and were made up of a variety of light, humidity, proximity, temperature, and current sensors, among other components. Control is achieved by the use of a variety of actuators that are triggered by the information collected from the sensors. The user has the option of connecting to the server and exercising complete control over the location if they so desire. Due to the ease with which the system can be deployed in any location, the system's application field is vast, allowing us to monitor as many sites as we want at the same time. The device can be installed in either a home or an office, and it will provide us with an accurate estimate of the amount of energy that has been consumed. It also has the potential of controlling the quantity of energy consumed from any location. Because it allows for perfect control over the temperature, it will also increase safety in a variety of industrial contexts. For a number of applications, sensors and actuators can be customized to meet specific needs. For example, they can be used to monitor a mechanical system or any industrial robot or machine, among other things. As a result of this update, it can be used to monitor a large number of robots in order to verify that they remain inside specific specified bounds. If necessary, the actuators might be utilized to shut down the system in a matter of seconds if it were necessary. Furthermore, this information can be transmitted to a centralized system for storage. The development and implementation of a similar application of this type was previously documented in [4]. Examples of how similar applications might be used to benefit the environment include the construction of buildings that are more environmentally friendly and that have lower lighting and heating expenditures. Using this technology in an industrial setting would result in the establishment of a more secure system that could be more easily monitored, as well as a system that could be more easily networked.

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