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Agriculture Power Station Circuit Breaker using LTE Communication

Mrs. Smitha A B[1], Meghana D Shetty[2], Neeharika U Devadiga[3], Sannidhi[4], Abhilash[5]

[1]Professor, [2,3,4,5]Student
Department of Electronics and Communication Engineering, Sahyadri College of Engineering and Management, Mangalore, India

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Abstract - *The time has changed and now technology has seeped into the agricultural sector. Where smartphones have become a useful tool in agriculture because of their computing power allows a variety of practical applications to be created. Using which the farmer can handle his agriculture's power station with the help of mobile app. whenever the farmer is in need of turning off/on the power station due to some uncertain condition or stuck with some work, where the motor, pump or other appliances is kept running on the other end which is unnecessary and in those situations one can make use of mobile app. Where he need not run from one field to another field to switch off the power supply/station risking his life. While turning off the power station circuit breaker plays a major role which are implemented as switches where an open circuit breaker has infinite load. So it is necessary for the farmers to protect themselves from electrical accidents that are happening when farmers come in contact with electricity and lose their life. The automation in agriculture is the main concern using which one can make his work faster along with the things getting faster farmers gain knowledge to operate the mobile phone and acquire them to the new technology.*

Key Words: **Mobile Application, Database API, Raspberry pi, Circuit Breaker, LTE Module.**

1. INTRODUCTION

As per a story that appeared in THE TIMES OF INDIA on May 23, 2021, India loses 11,000 agricultural laborers to electrocution each year. Averages of 30 people pass away each day. The causes are cited as not adhering to wiring regulations, frayed and broken transmission lines brought on by ageing, corrosion, and the development of conductive paths on motor casing and control boxes in wet environments. Whatever may be the reason it is our farmer who provide food for the nation are dying because of these electrical hazards. Unexpectedly, the government had taken an initiative to start a new scheme called KUSUM Yojana's component B which is designed to safeguard farmers from electrical shocks. Distribution transformers are typically situated on or near agricultural grounds. High-voltage 11/33 kV cables are installed from the substation to the distribution transformers. On the 440 V side of the transformer, agricultural pump sets are positioned anywhere from 10 to 300 meters away. Power lines break and fall to the ground as a result of corrosion, ageing, and improper standards not being followed during building. One of the leading causes of electrocution fatalities is a cut live wire that falls to the ground. Earth typically provides less resistance, although not always a perfect short. The current's strength is sufficient to deliver a lethal shock but not enough to trip the circuit breaker. Most of the time, the severed wire that is buried in the ground blends into the moist clayey soil and is not apparent. Unknowingly treading on this line can electrocute people and animals. Due to the loose dirt, wet weather, and flimsy foundations in agricultural fields, cut electrical cables falling to the ground occur more frequently.

On a farm, electrical power is both a necessary resource and, if improperly handled, a potential cause of issues. Electric current always completes a circuit as it moves from a power source to the equipment it is powering and back to its source along an electrical supply chain. To send the current back to the supply source, every electrical supply system requires a neutral conductor. This neutral conductor is also grounded. Because electricity is by its very nature far more adaptable than the older power sources, its influence on contemporary agriculture has been at least as important as that of either steam or gasoline. The development of the electric motor, however, really sparked the curiosity of the farming community, even though there had long been a scholarly interest in how electricity affected plant growth, especially after the advent of electric lighting.

By using this strategy, the current is given a "path of low resistance" to travel on as it returns to its source. Under typical circumstances, a small fraction of the electrical current that travels down the grounded neutral conductor also travels through the earth. This produces a small but quantifiable amount of neutral-to-earth voltage (NEV) at each location where the electrical system is grounded. Electric current finds a different route to the supply source through the earth when neutral conductor damage occurs, whether through a storm, corrosion, or a bad connection. Because of this, NEV levels will rise and stray voltage may be generated. Usually, a farm's electrical lines have two conductors, or wires. One illustration is the power supply (hot) conductor, which sends primary electrical current to the farm transformer. The second conductor, often known as the power line neutral, carries the primary current back to the power supply substation.

1.1 Problem Statement

According to the data sets of farmer's electrocutions, we see that people working on the farm are dying because of electric shock or some electric hazards. From the article times of India, five farmers were died due to electrocution where they came in contact with 11kv live overhead wire. Their bodies bore sever burn marks due to high voltage. After the incident, a complaint was filed sometimes the given complaint may be investigated. But most of the times it will go unseen.

We often tend to see that whenever there is heavy thunderstorm or lighting the farmer runs to their farm to turn off the power station risking their lives. And in other case the electrical accidents to the farmers are increasing, while operating power stations due to the fault in the electrical lines where current may contact with human body which risks their lives as shown in Figure1.1 below, this project gives a solution to this problem to ensure farmers safety. In this proposed system the control (ON/OFF) of the power station current lies with the farmer. This project is arranged in such a way that the user can sit at one particular place and operate using mobile application.

1.2 Objective

- This proposed system provides a solution, which can ensure the safety for the power station in the agriculture field which provides the power to the irrigation system or smart farming system or any other AC appliances from the thunderstorm and heavy rain.

- This initiative has the potential to automate farming practises, reduce risk and waste, and make wise decisions to increase quality and quantity.

- Agriculture requires a lot of energy to be productive. Energy is directly used in agriculture as fuel or electricity to power tools and machinery, heat or cool buildings, and light up farms. Indirectly, energy is used in agriculture in the form of fertilizers and chemicals made off farms.

2. LITERTURE REVIEW

[1] Mrs. B. Mounika: In this paper, it is mainly designed to control a circuit breaker with the aid of a password. Here line works with the help of lineman, where password is required to operate the circuit breaker. If the password is correct then he can turn (ON/OFF) the line and can repair comfortably. After this he can turn ON the line by entering the same password. It's controlled by using AT89S52.

[2] Agraj Aher, Janhavi Kasar, Palaash Aahuj, Varsha Jadhav:

The primary goal of this paper is to gather information about agriculture locations. Farmers will access through cloud services, where smartphone app is used. The remote monitoring system for agriculture sector will be the main topics of this study. The major goal is to gather information and support farmers in various action which results in a smart crop land.

[3] Shukla, A. and Jain, A: By utilizing the node MCU Wi-Fi module, this hardware offers a practical and efficient solution to the identified issues in Indian farming systems. This system uses an IoT-based Wi-Fi module that automatically alerts the upkeep of water requirements, fire alerts, and adequate electrical delivery by showing real-time data globally. Both manually and automatically controlled relay operations are possible via the internet.

[4] Aliev, K., Jawaid, M.M., Narejo, S., Pasero, E. and Pulatov, A:Our research's main objective was to develop an Internet of Things (IoT)-based system with a prototype device and an Android app functioning as a hotspot to gather physical data from remote items and send it to the cloud. We researched IoT standards, protocols, and network architecture before deciding which ones would work best for our IoT solutions. Given the demand for long-distance communication and energy-efficient solutions in the agricultural sector, we

presented the WSN technology, which is ideal for field smart agriculture applications.

[5] Khoa, T.A., Man, M.M., Nguyen, T.Y., Nguyen, V. and Nam, N.H: In order to control environmental conditions in agriculture, this paper provides a method leveraging LoRa module transmission for smart agriculture system. Improvements in IoT gives more assist to water management and smart agriculture. A novel sensor node topology is used as a low cost. User can control the farms using the mobile application while the complete sensor network is constructed and tested in the research lab.

[6] Zhang, Y., Kabir, M.M.A., Xiao, Y., Yao, D.D. and Meng, N: . Our approach aimed to identify gaps between current work and developer needs by evaluating current tools from various angles. We looked into the issue of whether the current tools are adequate to assist developers in removing abused cryptographic APIs. Our quantitative and qualitative examination of the available tools produced a number of intriguing results. The most cutting-edge technologies available today use interprocedural programmer analysis to find API abuses.

3. SOLUTION OUTLINE

FIGURE 1: Solution Outline

This proposed system provides a solution, which can ensure the safety for the power station in the agriculture field, where the farmers need not go to the power station to OFF\ON power supply he can turn OFF or ON power supply using the mobile app. When the farmer gives the certain command to the mobile app it checks for the particular API stored in the database as shown in Figure 4.1 above. After finding the correct API given by the user from the database that API is linked to the Raspberry pi's API through internet with the help of LTE module which access the internet over the LTE where Raspberry pi should be connected to the circuit breaker. And the circuit breaker breaks accordingly based on the command. Agriculture field provides the power to the irrigation system or smart farming system or any other AC appliances from the thunderstorm and heavy rain.

4. FLOW CHART

4.1 Transmitter

The proposed application for the farmer which has a good graphical interface so that the farmer can easily control the agriculture field power station. During heavy rainfall or thunderstorm, it is not necessary for the farmer to run towards his agriculture land power station to turn it OFF. By sitting at one place, he can turn off the main power supply and also can protect the power source, irrigation system and smart farming by using this mobile application. This application will also display the current state of the line (ON/OFF) as shown in Figure 2. When the farmer triggers the line using a mobile app, the data from the mobile phone will be sent to the database API.

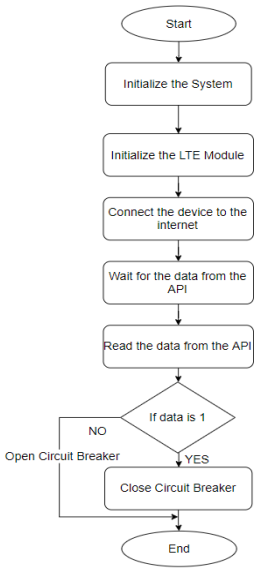

FIGURE 2: Transmitter

4.2 Receiver

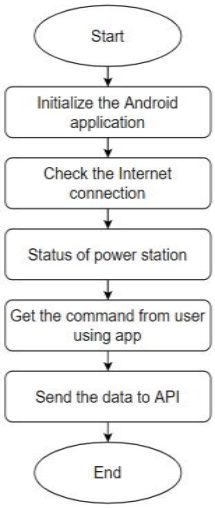

FIGURE 3: Receiver

The receiver station is placed in the agriculture field station which initializes LTE module. Whenever the data is received from the database API, it reads the data from the API. If at all the data read by the system is 1 then, raspberry pi initiates the circuit breaker to close. If data read is 0 then, raspberry pi initiates the circuit breaker to open as shown in Figure 3.

5. METHODOLOGY

We often see that during heavy rainfall or thunderstorm farmers need to run to their farms. In other case we can say that if at all the farmer's house is far away from the farm, it will be difficult for him to turn off the power station. We have

built an app so that he can operate the power station sitting in one particular place without any risk or difficulty.

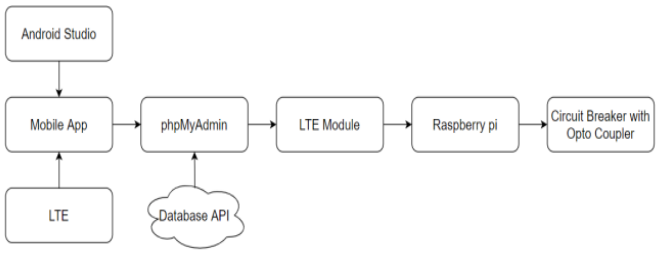

FIGURE 4: Methodology

The detailed working of above Figure 4 is illustrated below, Android Studio was used to create the mobile application. Android Studio is the name of the authorized integrated development environment (IDE) for building Android applications. Linux operating systems in 2020.

5.1 phpMyAdmin

MySQL management on the web is handled by phpMyAdmin. Numerous operations on MySQL and InnoDB are supported by phpMyAdmin. While you can still directly execute any SQL command, you may perform frequently used actions via the user interface.

5.2 Database API

Within the phpMyAdmin database, the My SQL PHP API is established. Three APIs were established by us using PHP code. First API to get data from database. Second API to update the data ON to the database. Third API to update the data OFF to the database.

5.3 LTE Module

Here in our project, we are using LTE module to get internet also we are inserting SIM card to the LTE module which can access the network from ISP. When the internet is connected to the SIM card LTE module will provide the necessary internet to the raspberry pi. This internet can be used to access raspberry pi which will connect to the database API. Also, always keeps on monitor the state of API. So, the advantage of our project is that, we need not provide the external internet facility to the Raspberry pi.

5.4 Raspberry pi

Raspberry pi initially connected to LTE module to access internet through this Raspberry pi connects to phpMyAdmin database which in turn connects to the API. Also, it always monitors the state of API by calling GET API. When the raspberry pi receives ON data it closes the circuit breaker. When the raspberry pi receives OFF data it opens the circuit breaker.

5.5 Circuit Breaker

Figure 5 illustrates the working of circuit breaker, which regulates the flow of current through both the positive and negative half cycles of an alternating waveform, the TRIAC (triode for alternating current) is an excellent power electronics switch to employ for switching applications. It also has the advantage of being less expensive than a back-to-back thyristor circuit.

One advantage using a triac to manage current up to 4A, voltage up to 600V, and little inrush; anything above that, a back-to-back thyristor can function just well.

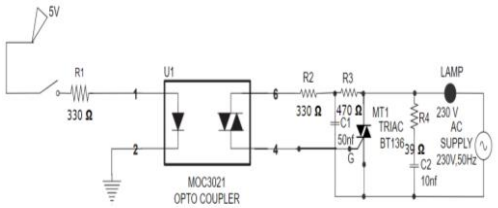

FIGURE 5: Circuit Diagram

During ON condition:

Pins 1 and 2 of the MOC3021 devices contain gallium arsenide infrared emitting diodes when the micro-controller supplies 5v/3.3v to the Opto-coupler. This diode emits infrared light, which activates the silicon bilateral switch at pins 6 and 4 that is optically connected to light and permits

current to flow between them. Pin 3 of the TRIAC receives GATE current from this source, while pins MT1 and MT2 of the TRIAC carry the main current

During OFF condition;

Since here is no Gate current flowing through the Optocoupler's pins 1 and 2, pins 6 and 4 operate as closed switches and stop conducting when 0 volts are applied between them.

6. RESULTS

On the successful implementation of the system, where farmer can easily operate the load during heavy rainfall or thunderstorm instead running towards the land to OFF the system risking his life. Firstly, we are creating a Database in phpMyAdmin and inside phpMyAdmin we are creating API. After creating the API, we are building Mobile application, where the Raspberry pi receives message from mobile application with the help of API. The Raspberry Pi shuts off the circuit breaker if it receives data indicating ON. In response to receiving OFF data, the raspberry pi opens the circuit breaker. Also, this system might be useful in terms of smart farming, irrigation system or the farm which

consumes large area where we can turn OFF the load of whole field at one stretch. The final prototype of our project is shown below in Figure 6.

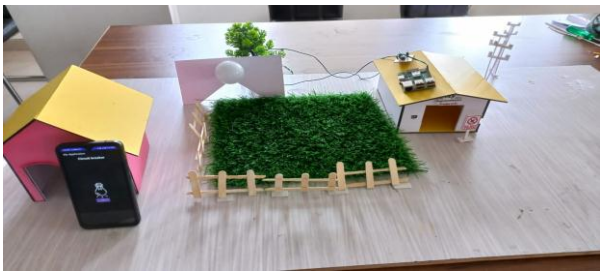

FIGURE 6: Prototype

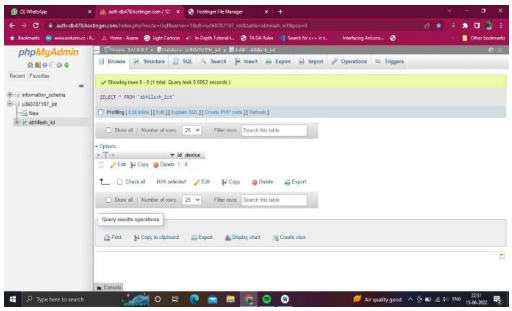

FIGURE 7: Creating a Database

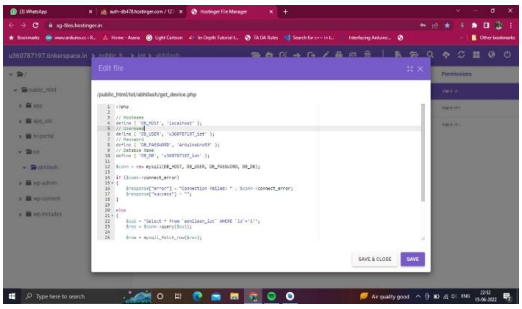

FIGURE 8: Creating a API

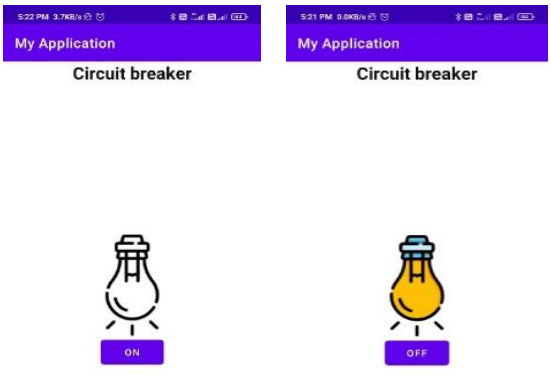

FIGURE 9: Mobile Application

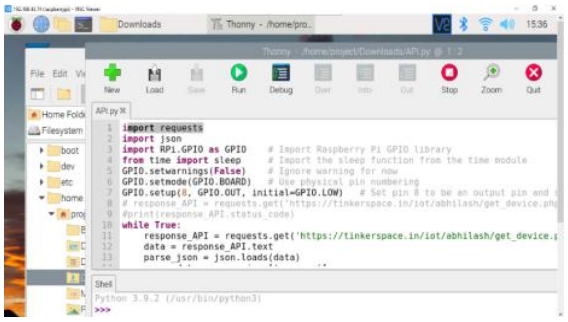

FIGURE 10: To link API and interfacing Raspberry pi

7. CONCLUSIONS

In concluding the words of our project, our project offers farmers who operate in the agriculture industry a solution. Whenever the farmer is in need to turn off the power station, he can turn it OFF or ON using the Mobile Application. The app which is done using Android Studio and Database is created to store the data in the cloud. Stored information has an API for each action. Then that API is linked to the Raspberry pi where it triggers the Circuit Breaker .It safeguards every device against damage and is a crucial component of electrical networks. It aids in the identification of the defect and the afflicted area.

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