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IoT-Based Real-Time Electric Line Fault Detection with Automated Cut-Off System

M. Pradeep Kumar[1], I. Gowshik Raj[2], J.Sathya Priya[3]
Information Technology,Velammal Engineering College, Chennai, Tamil Nadu, India

Abstract: Electric line faults such as wire breakage or fallen conductors pose a serious threat to public safety, especially when the affected line continues to carry live current until manual intervention is performed. In conventional power distribution systems, fault identification and power isolation are often delayed due to dependence on human reporting and inspection, which increases the risk of accidents and fatalities. To overcome this limitation, this paper presents an IoT-based real-time electric line fault detection system with an automated cut-off mechanism.The proposed system continuously monitors the continuity of the electric line using a sensing mechanism interfaced with a microcontroller. When a line discontinuity occurs due to wire fall or breakage, the system immediately detects the fault and triggers an automated cut-off response to isolate the affected line, thereby enhancing public safety. Simultaneously, the fault status is transmitted to a web-based monitoring dashboard, which can be accessed through a laptop or control room system by Electricity Board (EB) officials.The system is designed to operate in real time, providing fast fault detection, reliable alert visualization, and automatic restoration once the line continuity is re-established. Experimental validation using a prototype demonstrates the effectiveness of the proposed approach in reducing response time and improving operational safety. The proposed system is simple, cost-effective, and suitable for smart power distribution and safety-critical applications.
Keywords: Electric Line Fault Detection, Automated Cut-Off, Internet of Things (IoT), ESP32, Power Distribution Safety, Real-Time Monitoring, Web Dashboard

I. INTRODUCTION

Electric power systems are really important to our lives because they bring electricity from big stations to our homes, stores and factories. We need these systems to work all the time and be safe. If something goes wrong with the electricity distribution it can be very bad.When the power distribution fails it does not just mean we do not have electricity it can also be dangerous for people. Can damage things we own. Electric power distribution systems are crucial, for people who live in houses people who own stores and people who work in factories and other places.Power distribution systems have a lot of problems. One big issue is when something goes wrong with the lines. This can be a wire breaking, a conductor coming loose or an overhead line falling down. These things can be really bad.

In a lot of places people use electric lines because they are cheap and easy to put up.. The thing is these lines are always out, in the open so they get affected by the weather and other outside forces. Overhead electric lines are always dealing with these mechanical stresses. The electric lines get damaged a lot. This happens because of things like rainfall and storms. We also have to deal with lightning and strong winds that can hurt the lines. Sometimes tree branches. That is a problem too.

People can also cause damage to the lines. For example when a car crashes into a pole it can break the lines. Construction work can be bad, for the lines well. The older the lines get the more likely they are to get damaged. The electric lines are affected by all these things, including rainfall, storms, lightning, strong winds and falling tree branches and also vehicle collisions, construction activities and aging infrastructure.

When an electric wire breaks or falls onto the road, pavement or a public place it is very dangerous. The big problem is that the wire on the ground can still have electricity running through it even if it is broken. This is really bad for people walking by, animals and cars driving near the wire. They can get a shock, from the electricity. Many bad things have happened because the power was not turned off enough when a wire fell. Electric wires that fall down are a risk because people can get hurt if they touch the electric wire.

Dealing with problems on lines is a big worry. One of the issues is that it takes a long time to stop the power.In the system for sending out power finding faults and turning off the power often depends on people telling us about the problem or workers checking with their own eyes.

When we find out what is wrong it can still take a pretty long time to stop the power to the line that is affected.This is because it takes time to talk about it it is hard to get to some places. There are rules we have to follow.While we are waiting, the line that is damaged is still live which means something bad could happen to people.

The electric line remains a risk during this time and the delay, in stopping the power to the electric line is a major concern.We have things like relays, circuit breakers and fuses in substations to protect the equipment. These things are not really made to keep people safe when it comes to the lines that bring power to our homes. Sometimes these systems do not work well when there is a problem in a small part of the power line. This can happen when a line is partially disconnected or when a wire falls down. A lot of the systems we have now are good at telling us when something is wrong. They do not always do something to prevent an accident from happening right away. We need to think about the safety of people when it comes to the power distribution lines. The protection mechanisms we have now, like relays, circuit breakers and fuses are important. They are not enough to keep people safe.

The Electricity Board control room has a problem. They do not have a way to see what is happening with the power in real time. Often the people in the control room at the Electricity Board find out about problems after a long time has passed. This makes it hard for them to figure out how bad the situation is and do something about it away. The Electricity Board control room does not have a system to monitor things in real time and they do not get clear warnings when something is wrong. This makes it harder for them to understand what is going on and make decisions especially when something bad is happening or the weather is really bad, at the Electricity Board.

We have seen a lot of progress in embedded systems and microcontrollers and Internet of Things technologies.Now we can make systems that can watch things all the time and make decisions on their own and react fast.Internet of Things systems let devices in the field collect data and look at the information and talk to servers or dashboards, on the internet.This means we can see what is happening with the system now and if something goes wrong we can see that too.

This makes it a lot easier to keep an eye on things and react quickly when something goes wrong with the Internet of Things systems and the embedded systems and microcontrollers.

Automation is really important for making power distribution networks safer. Automated systems can work all the time without people watching them. They can react right away if something goes wrong. When we combine automation with sensors and communication tools we can find problems early on and fix them quickly. This is especially useful in situations where peoples lives in danger like in power distribution networks, where automation helps keep people safe. Automation, in these networks is very valuable because it helps prevent accidents.

The new system is about using Internet of Things technology to find faults in lines right away. It has a mechanism that checks the electric line all the time using a sensor that is connected to a small computer called a microcontroller. If something goes wrong with the line like a wire falls or gets disconnected the system finds out away and turns off the power to that line automatically. This helps to stop electricity from going through damaged wires, which makes people safer. The electric line fault detection system is really important, for safety because it helps to prevent accidents.

The proposed system does more than automatic safety response. It also gives real time warnings when something goes wrong. These warnings show up on a website that the Electricity Board officials can look at. They can check the warnings on a laptop or on a system, in the control room. This helps them find out what is wrong away and work together to fix it. The system is made to get everything working again on its own once the electricity line is fixed.

The primary objective of the proposed system is to minimize response time, reduce dependency on manual intervention, and improve public safety in power distribution environments. By combining real-time sensing, automated cut-off action, and IoT-based alert visualization, the proposed approach offers a practical, cost-effective, and reliable solution for modern power distribution systems. The system is well suited for smart grid applications and safety-critical infrastructure where rapid fault handling is essential.

II. LITERATURE SURVEY

Table 1. Summary of Literature Survey

Sl. No	Author / Year	Methodology Used	Key Features	Limitations Identified
1	Various	Manual inspection and fuse-	Simple implementation, widely	High response time, fully

Sl. No	Author / Year	Methodology Used	Key Features	Limitations Identified
	Researchers	based protection	used in early systems	manual, unsafe during fallen wire conditions
2	Previous Studies	Relay-based fault detection at substations	Fast equipment protection, reliable operation	Limited to substations, does not address distribution line faults
3	Research Works	Microcontroller-based fault detection using voltage sensing	Improved detection accuracy, reduced human effort	Only fault indication, no automated cut-off
4	Embedded System Approaches	Current sensor–based line monitoring	Real-time current monitoring, low cost	Cannot ensure safety isolation during wire fall
5	GSM-based Systems	SMS alert generation for power line faults	Remote notification, simple communication	Delay in response, no real-time visualization, no auto cut-off
6	IoT-based Monitoring Systems	IoT-enabled sensors with cloud platforms	Real-time monitoring, remote access	Mostly monitoring-only systems, lacks automated safety action
7	Web-based Control Systems	Control room dashboards for fault visualization	Better situational awareness,centralized monitoring	Depends on manual intervention for power isolation
8	Protection Automation Systems	Automated breakers and relays	Fast fault isolation, reliable hardware	Complex, costly, not suitable for small-scale distribution lines

Discussion Based on Literature Survey

When we look at the information in Table 1 we can see that people have come up with ways to find and watch problems with electric lines. These old and new systems can tell us when something is wrong and send out alerts.. Most of them need people to get involved and fix the problem, which can take a long time.. They only watch what is happening. The big problem is that most systems do not have a way to automatically stop the power at the place where it is sent to people. This is an issue, with electric line fault detection and electric line fault detection systems. Electric line fault detection is a thing. This research addresses this gap by proposing an IoT-based real-time electric line fault detection system with an automated cut-off and web-based alert visualization, focusing on public safety and rapid response.

III. EXISTING SYSTEM

The way we find and fix problems with power lines is old fashioned. We usually do it by looking at the lines ourselves getting complaints from people and using devices to protect the lines. When a power line breaks or falls because of the weather or something is wrong with it people who live nearby usually tell us about it or the people from the Electricity Board find it when they are checking the lines. This takes a time from when the problem happens to when we actually start to fix it. We are talking about the Electricity Board people and the power lines they are, in charge of.

We use things like fuses, relays and circuit breakers at substations to keep equipment safe from too much power and short circuits. These things work well to prevent damage to equipment like transformers.. They do not really help with safety problems on the lines that carry electricity to our homes. Sometimes when a line is damaged these protection devices do not turn off the power away. This means the line can still have electricity running through it even when it is broken or on the ground. Electrical equipment like circuit breakers and fuses are important. They are not enough to keep people safe from electrical accidents, on the distribution lines.

Some systems use methods to check the electricity. They look at things like voltage and current. These systems can find problems. Sometimes send out warnings.. Most of the time they only look for problems and tell people about them. They do not stop the power from coming in. This means that people have to do it which takes longer and can be dangerous, for everyone while we wait.

GSM-based alert systems have been talked about in studies to send messages to the people in charge when something goes wrong. These systems are better than telling people in person. They have some problems like delays in the network no real-time pictures and no safety actions that happen automatically. Also alerts that use SMS do not keep watching what is happening all the time or give information about the system. GSM-based alert systems do not do a job of keeping us informed, about what is going on with the system.

In the few years people have started using Internet of Things based systems to keep an eye on power systems in real time. These systems use cloud platforms and dashboards to show what is going on. They let people check on things from away and help the people in the control room know what is happening.. Most of these Internet of Things based systems just show what is going on and do not automatically turn things off when something goes wrong. So when it comes to keeping people safe we still have to wait for someone to do something manually. That takes time. Internet of Things based systems are good, for monitoring power systems. They do not do much to automatically fix problems when they happen.

Overall, the existing system suffers from several limitations, including delayed fault detection, high dependency on human response, lack of automated safety cut-off, and insufficient real-time alert visualization. These drawbacks highlight the need for an improved system that can not only detect electric line faults in real time but also perform an automated cut-off action and provide immediate alerts through a centralized monitoring platform. The proposed system aims to overcome these limitations and enhance safety in power distribution networks.

IV. PROPOSED METHODOLOGY

The method they are suggesting is to keep an eye on the electric distribution lines all the time. This way they can find out away if something is not right and start safety measures automatically.They want this to happen in time so they are using automation and special communication that uses the internet to talk to the devices. This is better than the way of finding faults in the system because it is faster and more reliable. The electric distribution lines will be safer, with this method.

The way we do this is we always keep an eye on the line. We use a tool that is connected to the distribution line to check what is going on. This tool is very important because it helps us figure out if the electric line is working properly or not. When everything is working like it should the electric line is fine. The tool sends out a signal that says everything is okay. This signal is always being sent to the microcontroller so it can look at the information and do what it needs to do with the line.

The microcontroller is the part of the system that makes decisions. It is programmed to check the sensor values from time to time and see if they are okay. The microcontroller compares these values with some limits that we have already set. Long as the sensor values show that everything is fine with the line the system works normally. When the system is, in this state it is safe for power to flow so the system just keeps watching and does not send any warnings. The microcontroller and the system keep doing this because the microcontroller is always checking the sensor values to make sure the system and the microcontroller are working properly.

When something goes wrong with the line like a wire breaks or gets disconnected or a conductor falls it affects the connection. This problem causes a change in what the sensor shows. The microcontroller sees this change away and knows it is a problem. The microcontroller is supposed to find the problem and correctly so it can respond as soon, as possible when something goes wrong with the electrical line. The goal is to make sure the line and the microcontroller work together to fix the problem fast.

When the system finds out that something is wrong it switches from the state to the fault state right away. At this point the automatic cut-off mechanism kicks in. The automatic cut-off means that the system isolates the line that is affected so no more live current can flow through the damaged part. This is an important step, for keeping people safe because it really lowers the risk of getting electrocuted fires and other accidents that could happen after the first one.

At the time the system starts making alerts. It sends information about the problem like what's happening with the system and what the problem is, to a website that people use to keep an eye on things. This website uses internet connections that lots of devices use. The system sends this information away so the people in charge at the Electricity Board get to know about the problem immediately.

The alert shows up on a laptop or a special screen in the control room so the people working there can see what is going on and figure out what to do. The Electricity Board officials can look at the alert. Understand the situation, with the Electricity Board system.

The proposed methodology also includes monitoring even after the fault has been detected in the electric line. This means the system is always aware of what's going on with the electric line. When the people who do maintenance fix the line and everything is working again the sensing unit sees that the electric line is back, to normal. The microcontroller checks the sensor readings to make sure they are stable before it updates the state of the system regarding the line.

When everything is back to normal the system goes back to its state from the fault state. The system status, on the web dashboard gets updated to show that the line is working again and it is safe. This way the system works properly. We do not get fake alerts. The system restoration is important for the line to operate safely and reliably. The system restoration logic helps with that making sure the line is really restored and the system is working as it should which is the normal state.

Overall, the proposed methodology integrates continuous sensing, real-time fault detection, automated cut-off action, and IoT-based alert visualization into a single unified framework. This approach minimizes human dependency, reduces response time, and significantly enhances safety in electric power distribution systems. The methodology is simple to implement, cost-effective, and suitable for smart grid and safety-critical applications.

V. SYSTEM ARCHITECTURE

The electric line fault detection system is made up of a working process. This process shows how the Internet of Things or IoT is used to find faults in lines and turn off the power automatically. The system is different from systems that keep the hardware and software parts separate. The new system is one process that shows how it finds a fault, in a wire and sends an alert right away. The electric line fault detection system is easy to understand because it is one process.

The architecture starts with the electric distribution line. This line is always being checked to make sure it is working properly and that the current is flowing. When everything is working normally the electric wire stays connected. The current keeps flowing through the line. There is a sensor connected to the line that always keeps an eye on this and sends information to the microcontroller all the time. The electric distribution line is really important because it is the part of the system and the sensor is always watching the electric distribution line to make sure it is working correctly.

The microcontroller is the part of the system that makes decisions. It always checks the information it gets from the sensors. The microcontroller looks at this information to see if everything is okay or if there is a problem. Long as the wire is not broken the microcontroller keeps the system working normally and does not send any warnings. The microcontroller is always watching the system and the microcontroller makes sure the system stays in a state as long as the wire is fine and the microcontroller does not send any alerts.

When something goes wrong with the line like a wire breaks or a conductor falls the electric line is no longer working properly. The sensing unit finds out about this problem away and sends the information to the microcontroller. The microcontroller looks at this information. Figures out what is happening with the electric line. It knows that the electric line has a fault. The microcontroller is looking at the line and it sees that there is a problem, with the electric line.

When the system finds a problem it immediately turns on the shut off. This means it stops the electricity from getting to the broken wire. The automatic shut off is very important for safety in the system. It helps to reduce the danger of getting shocked or starting a fire, in places. The system does this to protect people from the electric line.

At the time the microcontroller sends the fault status to a web-based monitoring platform using an IoT communication interface. The microcontroller does this so the fault information can be seen on a laptop or control room system as a real-time alert. This helps Electricity Board officials see the fault condition away and do more maintenance work, on the microcontroller if they need to. The microcontroller and the web-based monitoring platform work together to make sure Electricity Board officials can fix the fault condition quickly.

The system can also fix itself. When you plug the wire back in and everything is working again the sensing unit sees that everything is okay and sends new information to the microcontroller. After the microcontroller checks that the input's stable it changes the system status from FAULT to NORMAL. Then the web dashboard shows that the system is working again. The architecture supports system restoration. The microcontroller updates the system status to reflect the restored condition of the system.

Overall, the proposed system architecture ensures continuous monitoring, fast fault detection, automated safety response, and real-time alert visualization. The architecture is simple, reliable, and suitable for practical implementation in smart power distribution systems where public safety is a primary concern.

VI. ALGORITHM DESIGN

The electric line fault detection system is made up of a series of steps that it follows to find problems. This system can automatically turn off the power when it finds a fault and it sends out alerts away through the internet. The system runs all the time so it can find faults quickly and respond in a way that people can trust. It does all of this with little help from humans. The electric line fault detection system is really good, at doing its job.

The system works in three stages: it starts up it finds faults and cuts them off and it gets restored. The algorithm makes sure the electric line switches smoothly between a state and a fault state depending on what is happening with the electric line at that moment. The algorithm is always checking the real-time condition of the line to make sure the system is working properly with the electric line.

Algorithm 1: Real-Time Electric Line Fault Detection and Automated Cut-Off

To begin you need to start the system. This is the thing you have to do. The system is what you will be working with so starting the system is really important.

Step 2:We have to set up a things. We need to get the microcontroller ready. The sensing unit also needs to be started. The IoT communication module has to be turned on. We have to connect the web dashboard. We need to make sure the microcontroller and sensing unit and communication module and web dashboard connection are all working together.

Step 3: Set the system state to NORMAL.

Step 4:We need to keep reading the sensor values all the time to check if the electric line is working properly. This means we have to monitor the sensor values to see if there is continuity or current flow, in the line. The sensor values will help us understand what is happening with the line.

Step 5:This is where we compare the value with the conditions we set beforehand which are the predefined threshold conditions. We do this to see if the sensed value meets these conditions or not. The sensed value and the predefined threshold conditions are what we are looking at in this step.

Step 6:If the system gets a reading that says everything is okay, with the line then it should stay in a state and keep checking. The system needs to keep an eye on the line continuity all the time. It stays in a NORMAL state when the sensed value is normal.

If the thing that is being measured shows that something is not connected properly or something is wrong then you should go to Step 7.

Step 7: Figure out if the problem is with the line. Is it a fault with the line, like a wire break or a conductor that has fallen down. The condition is an electric line fault which means it could be a wire that is broken or a conductor that has fallen.

Step 8: Trigger the automated cut-off mechanism to isolate the affected electric line and prevent the flow of live current.

Step 9: Generate a fault alert and transmit the system status to the web-based monitoring dashboard using IoT communication.

Step 10: Display the fault alert on the control room or laptop interface for Electricity Board officials.

Step 11: You should keep watching the line. This is something you need to do even after you find a problem, with the line. The electric line needs to be monitored all the time.

Step 12:If the line continuity is restored you should go on to Step 13. The line continuity is what is important here so if the line continuity is working.

If the problem with the equipment does not go away the system will stay in a fault state. It will keep giving us warnings that something is wrong, with the fault condition. The fault condition will just stay like that. The alert will keep going until the fault condition is fixed.

Step 13: Check that the line stays connected and working properly for an amount of time.

Step14: This is where we update the system state. We are changing the system state from FAULT to NORMAL. This is a step for the system. The system state needs to be updated to NORMAL, from FAULT.

Step 15: This is where we need to update the system status. We have to do this on the web dashboard. The system status should say that everything is working normally.

Step 16: End.

A. Algorithm Explanation

The system is turned on at the start. All the parts are set up. The microcontroller is always checking what the sensor is saying to see what is going on with the line. Long as the sensor is saying everything is okay the system stays in a normal state. The microcontroller keeps watching the sensor input to make sure the electric line is fine and the system stays in this state. The system and the microcontroller and the sensor all work together to keep an eye on the line.

When a wire falls down or gets disconnected the sensor finds out that something is wrong with the connection. The sensor detects the interruption in the wire. This change is immediately looked at by the microcontroller. The microcontroller then figures out that there is a problem it identifies the condition as a fault with the wire. The algorithm then does something about it it triggers the automated cut-off action to isolate the line this is done to keep people safe to ensure public safety, with the wire.

The fault information is sent to the web-based dashboard at the time. This happens through an IoT communication interface. The Electricity Board officials can see the fault status in time.

The algorithm keeps checking the line condition. It automatically restores the system to a state once the line is safely reconnected. The Electricity Board officials can then see that the system is back to normal on the web-based dashboard. The fault information and the system status are always available to the Electricity Board officials, through the web-based dashboard.

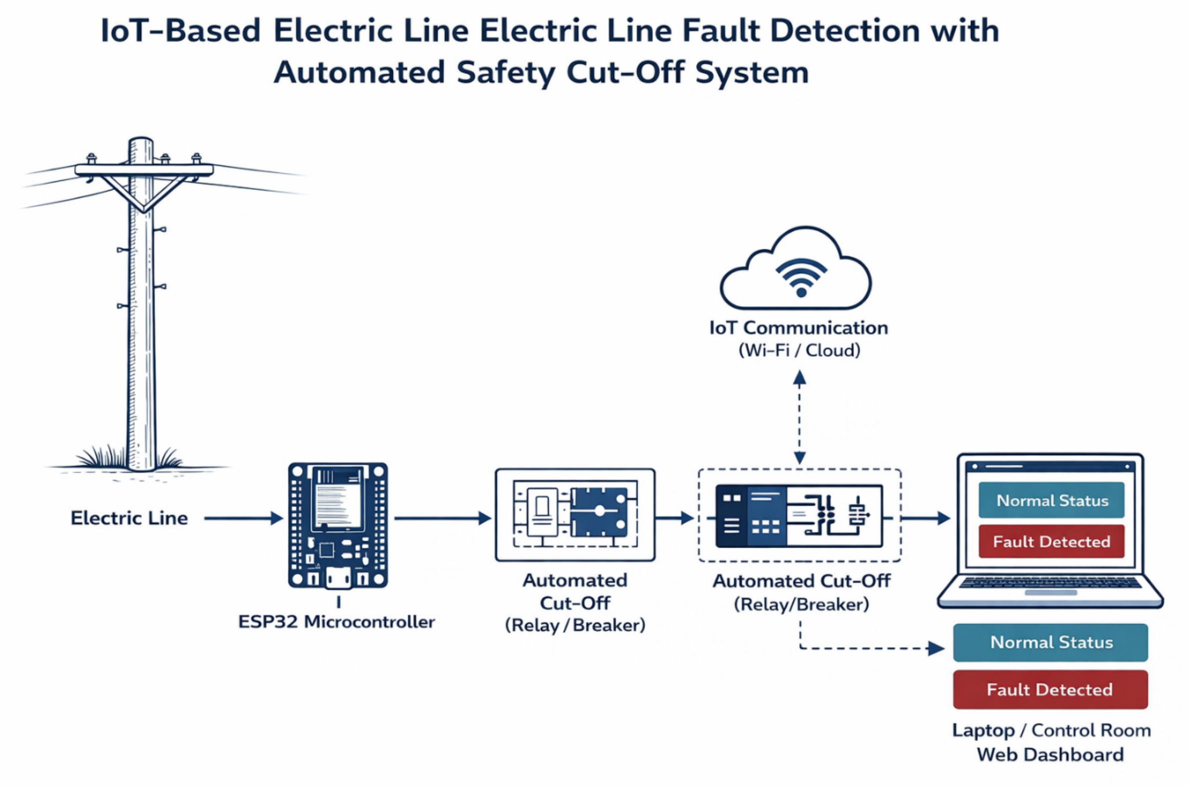

Fig. X. Flowchart of Electric Line Fault Detection and Automated Cut-Off Algorithm

B. Hardware Implementation

The system we are talking about is made up of hardware that can find problems with lines. This hardware is designed to do a things. It can detect when something is wrong, with the line. It can also automatically turn off the power when it finds a problem.. It can send messages to the people who are monitoring the system in real time.

We made sure the hardware is not too complicated and does not cost much. This way it can be used in the world where electricity is being sent to peoples homes and businesses.

The main part of the system is a microcontroller. This microcontroller is like the brain of the system. It gets information from the sensing unit all the time. Then it does what the fault detection and decision-making algorithm tells it to do. The microcontroller is, in charge of figuring out if everything is working normally or if there is a problem. It controls the automated cut-off mechanism. It also sends updates on the system status to the web-based dashboard. The microcontroller does all these things to make sure the system works properly.

The electric distribution line has a part that checks if the line is working properly. This part is like a watchdog that sees if the electric wire is still connected or not. Normally this watchdog sends a signal to the brain of the system, which is called the microcontroller.. When something goes wrong like the wire breaks or falls down the watchdog sends a different signal.

The microcontroller then sees this change. Does something about it. The electric distribution. The watchdog work together to make sure everything is okay, with the electric wire.

The automated cut-off unit is used to keep people safe when there is a problem with a line. When something goes wrong the microcontroller says it is time to stop the electricity from going through the damaged line. The automated cut-off unit does this by turning off the power. This is very important for safety because it reduces the chance of people getting hurt from electricity and it also reduces the chance of fires. The automated cut-off unit is a help in keeping everyone safe when there is a problem, with an electric line.

The Internet of Things or IoT needs a way to talk to other devices. So the microcontroller has an interface that lets it send information about problems to a computer that is far away. This computer is like a monitoring station. It helps the people in the control room or the ones using a laptop to see what is going on with the machines in the field. The microcontroller and the monitoring station can talk to each other easily which is very helpful, for IoT-based communication. IoT-based communication is very important here.

We use things, like power supply units and jumper wires and connecting terminals and indicator elements to make sure everything works properly. We can see what is going on when we test our prototype.

The whole hardware setup is put together on a development platform.

We test it when everything is working normally and when things are not working right to make sure the hardware setup is reliable and does what it is supposed to do.

The hardware is really good, at finding faults in lines and it does this in real time. This means it can sense problems respond quickly and communicate well. The electric line fault detection and automated cut off action work together to make sure everything is safe and reliable. The hardware is the base that makes all of this work properly.

C. Software Implementation

The software that runs the system is in charge of controlling the hardware running the fault detection algorithm and talking to the web-based monitoring dashboard in time. The software is made to run all the time and react away to any changes, in the electric line condition. The software implementation of the proposed system has to do these things to make sure everything works properly. The electric line condition is very important. The software has to watch it all the time.

The microcontroller is programmed with software that gets all the parts of the system working together like the part that senses things and the part that talks to other devices. When the system first starts up the software sets up the input and output connections figures out what values will trigger an alert if something goes wrong and decides how it will send and receive data with the microcontroller.

The software works by checking the sensor readings. It keeps reading what the sensors say. Compares that to some set numbers to see if the electric line is working properly or not. If the sensor readings show everything is okay the system stays in a state and just keeps watching without sending out any warnings. The software is always checking the sensor readings to make sure the electric line is, in a condition.

When the sensor finds out that something is wrong with the line, like a break or a problem the software right away says it is an electric line fault. The software then tells the system to turn off the power to that line. This makes sure the bad line is shut off away so people are safer. The electric line fault is a deal so the software makes sure to act fast when it finds an electric line fault.

At the time the software gets ready the information about the problem and sends it to a website that people can use to keep an eye on things. This website shows what is going on with the system now so people who work at the Electricity Board can use a laptop or a special control room to see what is wrong. The software also changes the system status back to normal when the electricity line is working properly again and everything is stable. The Electricity Board officials can then see that the system status is back to normal, on the website. The software does all this to help the Electricity Board officials keep track of the Electricity Board system.

The software is made to be simple to change. You can easily modify the threshold values and the communication settings and the alert logic. This means the system can work in situations and it can be improved in the future. The software is flexible so it can adapt to operating conditions and it can be updated with new features. The system is designed to be modular. This is what makes it adaptable, to different situations and it can be enhanced in the future with new features and improvements.

Overall, the software implementation ensures efficient coordination between sensing, decision-making, automated cut-off action, and real-time alert visualization. Combined with the hardware setup, it enables a reliable and intelligent electric line fault detection system suitable for smart power distribution applications.

VII. RESULTS AND DISCUSSION

The new electric line fault detection system that uses Internet of Things technology and automatically cuts off power was. Tested in real life situations. This system was checked to see if it can find out when a line is disconnected turn off the power by itself and show warnings on a website that people can use to keep an eye on things. The electric line fault detection system was tested to see how well it works when it has to detect line disconnection and trigger the automated cut-off action. The electric line fault detection system also had to display alerts on a web-based monitoring dashboard.

The electric line works fine when everything is normal. The sensing unit gives the microcontroller information and it stays steady. The system is, in a state and the dashboard shows that everything is working okay. There are no alerts or warnings. This shows that the system does not send out warnings when the electric line is healthy. The electric line and the system work together without any problems.

When someone pulled the wire out on purpose to see what would happen if a wire fell, the sensing unit right away saw that the wire was not connected anymore. The microcontroller looked at this change. Figured out what was going on really fast and it knew that something was wrong. So when it detected the problem the system automatically turned off. The status of the system changed from NORMAL to FAULT. The electric wire and the sensing unit and the microcontroller all worked together to make this happen. The electric wire was the problem and the sensing unit and the microcontroller fixed it by turning the system off when the electric wire was not connected.

At the time the system sent a warning to the website dashboard and it showed up on the monitoring laptop. The warning message said what was wrong which showed that the field device and the monitoring platform were talking to each other in time. When the wire was plugged back in the system saw that everything was working again and it automatically changed the status back, to NORMAL. The field device and the monitoring platform were working together again. The field device was sending updates to the monitoring platform.The results show that the proposed system is really good at finding faults it responds automatically and you can see the alerts clearly. When we compare it to systems it is much faster and people do not have to get involved as much. The proposed system is good for keeping people safe and making power distribution networks work better. The proposed system is effective, for making sure everyone is safe and that power distribution networks run smoothly.

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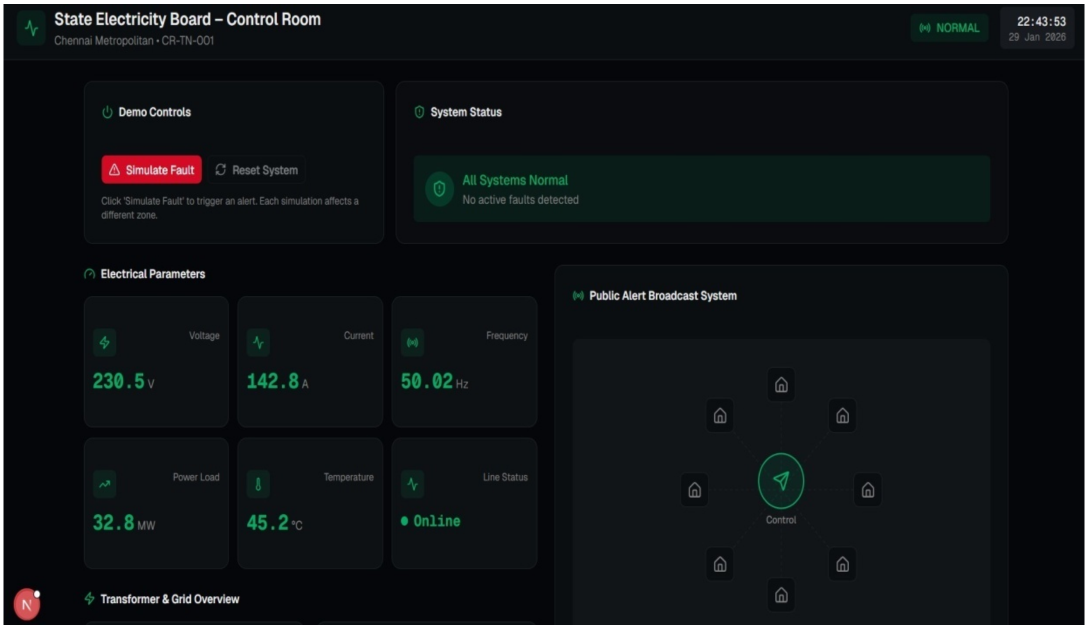
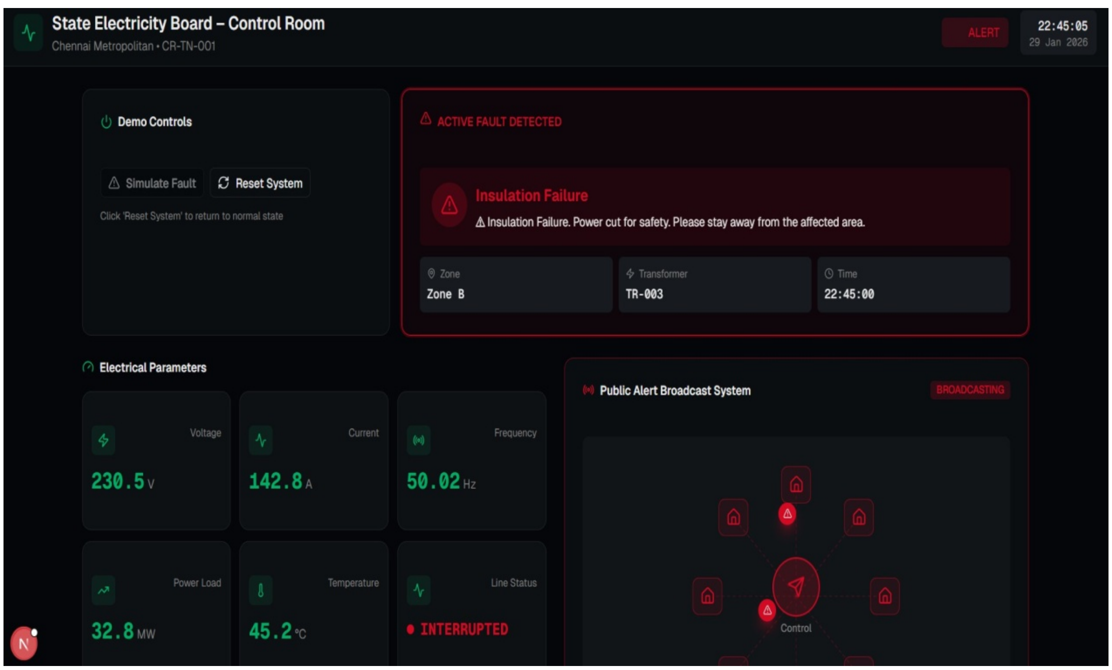
[1] Hardware Implementation.





[2] Software Implementation.

Advantages Of The Proposed System

The new system has a lot of things about it when compared to the old ways of dealing with problems, on electric lines.

Real-time detection of electric line faults.

Automated cut-off action to enhance public safety.

Reduced dependency on manual inspection and reporting.

Faster response time during fault conditions.

Web-based alert visualization for remote monitoring.

Simple design and cost-effective implementation.

Suitable for smart grid and safety-critical applications.

VIII. APPLICATIONS

The new system that uses Internet of Things technology to find faults, in lines and automatically turns off the power can be used in many different situations, including.

Overhead power distribution lines.
Urban and rural electricity distribution networks.
Public safety monitoring systems.
Smart grid infrastructure.
Industrial power distribution environments.
Educational and research-based smart energy projects.

IX. LIMITATIONS

The new system they are talking about can find problems. Keep people safe but the system has some issues.The prototype is made to show how it works when it uses an amount of power. The prototype is, for demonstrating things when you do not need to use a lot of power.

The performance of something really depends on how accurate the sensors how well the network is connected. If the sensors are not accurate and the network connection is bad then the performance will not be good. The sensors need to be able to give the information and the network needs to be able to send this information quickly and reliably for the performance to be good. This is why sensor accuracy and network connectivity are very important, for performance.

When you are doing a deployment you may need to get some extra protection hardware, for the machines. This is because big deployments can be a lot to handle and you want to make sure everything is safe and working properly. So you will need to get some protection hardware to help with that.

The environment can be really noisy. That noise can affect how accurate our sensors are in certain situations. Environmental noise is an issue because it can interfere with the way our sensors work. This means that environmental noise can make it hard for our sensors to get the information, in some conditions.

We can fix these problems by making the system better and trying it out in the field. The system needs to be improved. Tested more to deal with these limitations. The limitations of the system can be fixed by working on the system more and doing more field testing of the system.

X. FUTURE ENHANCEMENTS

We can make the proposed system better, in these ways:

Integration with GPS for accurate fault location identification.
Support for multi-line and multi-zone monitoring.
Mobile application for alert notifications.
Cloud data storage for fault history analysis.
Integration with advanced protection relays.
Deployment in large-scale smart grid environments.

These improvements will make the system better at handling things and they will also make the system smarter and more useful in the real world. The system will be able to do things and it will be more intelligent. The system will also be more applicable, in the world.

XI. CONCLUSION

This paper is about a system that uses the Internet of Things to detect faults on lines in real time. The system is designed to make people safer and to reduce the time it takes to respond to problems with power distribution.

The system constantly checks if the electric lines are working properly it finds faults away and it automatically cuts off power to the line that has a problem. This helps to isolate the line that is affected. It prevents more damage. The Internet of Things system is really good, at detecting faults on lines and it helps to keep people safe.The integration of IoT technology enables real-time alert visualization through a web-based dashboard, allowing Electricity Board officials to monitor and respond to faults efficiently.

Experimental results obtained from the prototype implementation demonstrate that the system is reliable, fast, and effective in handling fallen wire conditions.

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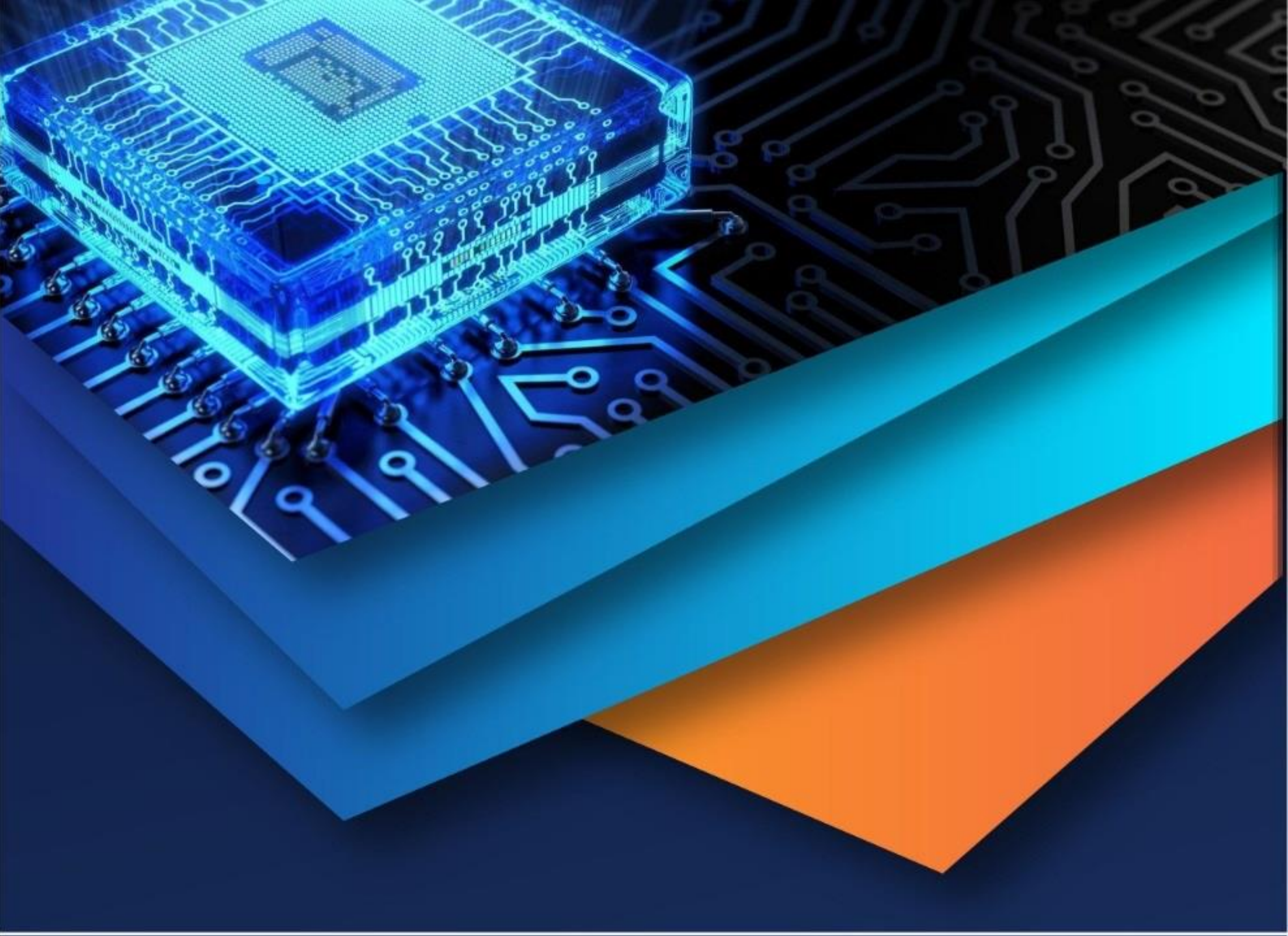

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