AUTOMATIC RAIN SHUTTER

EE8611-MINI PROJECT

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ABSTRACT

In recent years, the demand for automated systems has significantly increased, driving advancements in various domains, and give protection against the weather conditions. In current situation dhobi carts are exposed to atmospheric conditions. So, the clothes are wet and electrical components get being damaged. So, the scientists are decided to make automatic rolling shutter for them.

The proposed employs a Node MCU microcontroller, which acts as a central control unit, responsible for processing sensor data and triggering the rolling shutter motor. The rain sensor designated to detect the presence of rainfall, is strategically and sends a signal to the Node MCU which initiates the closing of the window. The implementation of the proposed rolling shutter system offers several benefits, including enhanced convenience, improved protection against rain damage, reduced damage, reduced energy consumption, and increased privacy. By automatically closing the rolling shutter in the presence of rain eliminates the need of manual intervention ensuring the dhobi carts are shielded from the rain.

LIST OF FIGURES

NOMENCLATURE

Node MCU	Node Micro-controller Unit
RSM	Rain Sensor Module
ESP	Electronic Stability programme
Wi-fi	Wireless Fidelity
IOT	Internet of things
PLC	Programmable logic controller
IC	Integrated Circuit
AC	Alternating current

CHAPTER 1

INTRODUCION

In recent years, the technology has been a growing demand for automated systems that enhance convenience and safety. On such application is the automatic control of rolling shutters, which provide protection against environmental conditions such as rain. In this introduction, we will explore the concept of rain sensing automatic rolling shutters and discuss how Node MCU, an open source IOT platform, can be utilized to create an intelligent and efficient system.

Rain sensing automatic rolling shutters offer a significant improvement over traditional manual or time-based control systems. By integrating rain sensors and a microcontroller like Node MCU, the shutters can be automatically activated or closed based on real time weather conditions. This ensures that the shutters respond promptly torain, offering protection to thedhobi carts.

Node MCU, based on the popular ESP32 Wi-Fi module, provides a versatile platform for IOT applications. Its compatibility with various sensors and ease of programming makes it an ideal choice for creating rain sensing automatic rolling shutters. By using the Node MCU built in Wi-Fi connectivity, the system can not only detect rain but also fetch

real-time weather data from online sources, enhancing its accuracy and reliability.

Automatic rain shutters have become increasingly popular in recent years due to their convenience, protection, and energy-saving capabilities. These innovative shutters are designed to automatically detect rainfall and close the window during rain. These will be very useful for the dhobis because their clothes are prevented by being wet and the clothes are not affected.

The advantages of inculpating Node MCU into this system are manifold. Firstly, it provides real-time monitoring of weather conditions, allowing for immediate response of rainfall. Secondly, it enables remote control of the shutters through mobile devices or web interfaces, providing convenience and flexibility for users. Additionally, Node MCU's ability to connect to the internet opens up possibilities for integrating the system with weather forecasting services, enabling predictive actions based on anticipated weather changes.

CHAPTER 2

LITERATURE REVIEW

The automatic rain sensing rolling shutter is used for the dhobis for safeguard the cloth from black spot during rainy season. The literature review for the above proposed project is stated below in this chapter.

2.1 RAIN DETECTION SYSTEM USING AURDINO AND RAIN SENSOR

Rain Sensor is a switching device activated by rainfall, there are two main applications for rain sensors, one is for the automatic irrigation system and another is for the automatic mode of windscreen wipers. This paper, is aimed at designing a rain detection system that uses a rain sensor to detect the rain. The rain sensor is used to detect any rainfall falling on it and then it will sense and perform the required actions. This system is controlled through Arduino. Arduino UNO board is sufficed to control rain sensor and also to interface the sensor. Whereas, the movement of the sensor is controlled by using a rain control module. This module is controlled using the Arduino Uno board as a microcontroller. The signal received from the sensor is processed using “Processing Development Environment Software".

Rain Sensor is one of the kinds of switching device which is used to detect the rainfall. It works like a switch and the working principle of this sensor is, whenever there is rain, the switch will be normally closed. In 1958, the Cadillac Motor Car Division of General Motors experimented with a water- sensitive switch that triggered various electric motors to close the convertible top and raise the open windows of a specially-built Eldorado Biarritz model, in case of rain. Raindrop sensor is basically a board on which nickel is coated in the form of lines. It works on the principal of resistance.

Rain sensor module allows to measure moisture via analog output pins and it provides a digital output when a threshold of moisture exceeds. The module is based on the LM393 op amp. It includes the electronics module and a printed circuit board that collects the rain drops. As rain drops are collected on the circuit board, they create paths of parallel resistance that are measured via the op amp. The sensor is a resistive dipole that show less resistance when wet and more resistance when dry. When there is no rain drop on board it increases the resistance so we get high voltage according to V=IR. When rain drop present, it reduces the resistance because water is a conductor of electricity and presence of water connects nickel lines in parallel so reduces resistance and reduces the voltage drop across it.

2.2 DESIGN AND IMPLEMENTATION OF RAIN SENSOR ASA PROTECTIVE SYSTEM

A rain sensor is a switching device activated by rainfall. The rain detector is a self-contained electronic device that generates a signal when its sensor is in contact with water. It can be used near washing machines, water heaters, toilets, sump pumps, bathtubs, dishwashers and high-efficiency furnace pumps. This device has the ability to detect leaks from toilets that have the phenomenon to cause mold growth.

This work focuses on using rain sensors to activate protectors using the agricultural sector as a case study. The intent of this work is to use rain sensor as a protector for valuable items that are rains sensitive to reduce over employment especially in the agricultural sector of the Nigerian economy. Thereby saving cost of labor to the employers and saving time and energy. The objective was to use original components and equipment in the construction, the programming language was also put into consideration.

During the construction process, the rain sensor circuit was tested on a bread board before it was transferred to the Vero board and lastly the rain sensor was constructed. This was to get rid of excess cost resulting from errors in the implementation of the circuit design. The implementation procedure adopted in this work was first designing the

circuit with the use of Proteus. The second step was to implement the circuit on a breadboard.

The third step was to implement the circuit on a Vero board, test and run. Then extensive ranges of tests were performed to determine the reliability and functionality of the device for 10 days. This achieved desired results in the time it takes the protector to respond to the signal produced from the output of the sensor.

Possible recommendations were highlighted aimed at improving it the more. The possible recommendations pointed out were the implementation of usage of the device to areas of the economy whether domestically, commercially or industrially, and the future researcher should follow up with a microcontroller like PIC or ARDUINO which has internal EEPROM and the more advance EEPROM technology/ data logger.

This design can be controlled by a simple incorporation of a voltage or current control machine/ induction system. And with the EEPROM, the operational settings of this dryer controller and its logged data can then be permanently stored on non-volatile registers/ ROM that preserve the logged data/ settings even when battery has been removed.

2.3 DEVELOPMENT OF AN RAIN WATER SENSING WINDOW

The present development of rain water sensing window is very helpful to protect the interior of houses as it works automatically by sensing the water. It is particularly very helpful device to use in rainy season. The concept of sensing rain water to close the window is not new. It has been developed to use in the automobile sector. But this invention can be used successfully for domestic purpose. This system can evaluate whether the water particles are contracting with the window or not and sensing this it will close automatically to protect the interior of the house.

The field of this work is mechatronics, which is a combination of mechanical and electronics has had great advancement in the past few years. Mechatronics is implementing in this development to construct an automatic controlled commercial window. Hashim et al.[1] tried to develop a new wiper system to wipe rain water from vehicle's windscreen.

In older system, wiper was used to control manually and the process of pulling up the wiper was quite difficult. So, objective of their work was to modify the system by providing automatic wiping system. They developed an automatic control system by using a Peripheral

interface controller and water sensor. Their system could manage to achieve the aim as it could remove rain water automatically from outside the car.

The rain sensing automatic power window has a rain sensor, a motor operating circuit, a pair of motors and a driver mechanism for sliding type windows. Powered by 12V DC power from a transformer, motors have enough torque to move the windows back and forth as required.

The rain falls on the sensor, it sends signals to the circuit. The microcontroller is programmed with MATLAB, which acts as a relay for thecircuit that sends signal to the motor driver which gives power to the motors. The windows are sliding windows with smooth bearings toreduce drag a friction for proper sliding movement.

The aim of this project was to develop a rain sensing automatic window mechanism for household. This project has been done derived for introducing automatic rain sensing windows of luxury cars and has been modified for application in commercial house window. The same principle works for both.

2.4 PLC BASED AUTOMATIC DAM SHUTTER CONTROLUSING WATER LEVEL SENSING

This paper based on controlling the process variable parameters such as level with real time implementation of gate controlling through DC motor using Programmable Logic Controller. In our proposed system, a programmable logic controller is used as a compact computer playing the major role of a control devices and switches provide incoming signals to the control unit. The system design is provided with two levels in which the onelevel in upper and one level in the lower outputs the ladder logic is actuated. Thiswork uses PLC of DELTA DVP-SE series inbuilt with 8 digital inputs and provides 4 potential free outputs to control the miniaturized process depicted in the work.

The farmers are mostly dependent on rain and after that bore-well water for their crops. Recently, all the farmers use in flood irrigation system for planting their crops which needs more water. As we know, water is gradually becoming one of the most valuable natural resources. As the solution to problem, we are developing this project to develop a PLC basedsystem which detects or senses the water level in dam and thereby control the movement of gates

automatically. Automation is use of various control systems for operatingequipment in industries such as machinery, processes in factories.

The biggest benefit of automation is that it is saves labor work; it is also used to save energy and manpower to improve quality, accuracy and precision, reliability. In this system we developed the overall method in many ways. First one is that the targeted device scan be controlled by PLC (Programmable Logic Controller).

In this section the method that we have developed to implement the system has been explained. There are various components we have used to implement this system. The whole system is divided into different sections and each are explained separately. PLC is heart of our proposed system which controls the entire operation of system. This compact DELTA PLC, economical programmable controllers offer several I/O configurations. In this PLC, there are 8 input and 4 output are available. These PLCs were programmed in "ladder logic", which strongly defines a schematic diagram of relay logic. Ladder logic is a programming language, that represents a program by a graphical diagram based on the circuit diagrams of relay logiccircuit. It is primarily used to develop software for programmable logic controllers (PLCs) used in industrial control applications.

2.5 AUTOMATIC RAIN SENSING WIPER USING AURDINO

A car wiper is a device used to remove raindrops from the windshield. Today, all vehicles are equipped with wipers to prevent accidents and reduce human intervention in controlling wipers for luxury. Wipers usually consistof a metal arm and a long rubber blade. Pneumatic energy is used in some vehicles. Here, the metal arm is driven by an electric motor. The blade moves clockwise and counterclockwise on the glass, pushing water out of the glass surface. Velocity changes occur automatically based on the intensity of precipitation. Most cars use two radial types.

Sync arms, while commercial vehicles use pantograph arms. Wipers are automated in many ways. Today's automobiles consist of a series of mechanical parts automated by electric motors. Here, we propose an unmanned wiper that detects rain and starts automatically, and turns off automatically when the rain stops. This eliminates the need for human physical intervention to control the speed of the wiper. For this purpose, a rain sensor is used to detect rain and the signal is managed by Arduino to take the necessary actions. Over the last decade, the automotive industry has made progress to find the latest technologies for increasing safety. There are many reasons for vehicles that are not equipped with automatic wipers. For many reasons, windshield wipers are too expensive to fit in an economical car and too unreliable for a new car. Many car companies have tried

to cheaply design car wipers that are both economical and efficient. In today's situation, only luxury cars are equipped with automatic rain sensor car wipers.

Our paper was created to emphasize the need to use an automated wiper system that starts automatically when it starts to rain. The wiper speed is automatically adjusted according to the intensity of the rain. Such a system guarantees the safety of the trip. There are many causes of accidents, but the main reason for accidents during the rainy season is poor visibility. The purpose is to design an auto-start wiper system that will start automatically when it rains. The wiper speed is automatically adjusted according to the intensity of precipitation. The project consists of an Arduino, a rain sensor, a servomotor, and an LCD module that displays precipitation. The wiper speed is adjusted according to the amount of precipitation, which improves safety. This project is a small step towards convenience and time savings.

2.6 DESIGN AND FABRICATION OF RAIN DETECTOR WITHAUTO SHUTTER

The farmers are drying rice, corn, etc. in the open site. The drying process is affected in rainy season. The farmers are using the plastic mat for covering the agriculture products manually during rainy season. Sometime the plastic mat gets wet by the rain water and

it creates the cracks and holes on the mat. So, we decide to protect them fromthe adverse conditions.

In this project, we introduce automatic roofing machine to safeguard the agriculture products during rainy season. The fabric sheet is rolled betweenthe two rollers which is fitted on the top of the pillar. The fabric sheet is closed on the agriculture products by means of LDR sensor which is used to sense the rainy droplets and it gives signal to the relay. The relay operates the two motors to roll the fabric sheet between the two rollers and cover the agriculture products. When the sunlight falls onto fabric sheet, relay operates the two motors to roll the fabric sheets between the two rollers and remove the roof for drying process. It can also be used in food processing industries, match and fireworks manufacturing factories and cement industries for automatic safe guarding of the drying products.

The conventional techniques used to cover working place is less efficient. Such technique led to increased maintenance and inspection cost. The present automatic roofing with the help of sensors and DC Motors help to cover complete or part of the working place as per our convenience. It is more efficient and requires less maintenance and convenience. This circuit consists of three parts namely microcontroller, comparator and Rain detector.

2.7 DESIGN AND CONSTRUCTION OF A WEATHER BASEDSLIDING WINDOW

Automation is the use of various control systems for operating equipment with minimal or reduced human intervention. It started in the late eighteenth century and become more popular in the nineteenth century. It has many advantages over the social and manual operation of any device, which accounts for the extensive research and exploration globally. As technology is finding diverse applications in the control, automation and monitoring of several devices. It has become necessary to implement these features in the design of doors and windows.

The automatic control of windows has worked on the few projects . Still, it has not been widely used with the society, unlike automatic doors which in use in almost location around the world. The concept of having a window started with making a small hole in the wall of a building and covering it with animal hide to prevent unwanted objects and harsh weather conditions. This was not effective as it could not stop the rain, and it was notsafe for the inhabitants. Several materials have been used for the windows including papers, wood, vinyl, steel, aluminum. Stained glass and clear glass.

The foremost materials failed and gradually evolved to the later elements. The frames are designed using steel, fiberglass, aluminum etc., but aluminum is chosen for the majority purpose because it is cheap and has the resistance to the corrosion. Hardware components are substantial parts of the design and contain power supply, microcontroller, rain sensor and temperature sensor.

2.8 RAIN DETECTION WITH AUTOMATIC CLOSING OFWINDOW

An embedded system is a computer system designed to perform one or a few dedicated functions often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. By contrast, a general-purpose computer, such as a personal computer (PC), is designed to be flexible and to meet a wide range of end-user needs.

Embedded systems control many devices in common use today. Embedded systems are controlled by one or more main processing cores that are typically either microcontrollers or digital signal processors (DSP). The key characteristic, however, is being dedicated to handle a particular task, which may require very powerful processors. For example, air traffic control systems may usefully be

viewed as embedded, even though they involve mainframe computers and dedicated regional and national networks between airports and radar sites. The project “Rain detection with automatic closing of window” was designed to control the window automatically based on the rain sensor detection.

Rain operated motor was designed based on conduction sensor (Tough sensor) circuit, Control Unit, stepper motor. The sensor was used to detect the rain or water flow. Therefore, when it senses window closes automatically & opens when it is not in contact with rain or water flow. Since the embedded system is dedicated to specific tasks, design engineers can optimize it to reduce the size and cost of the product and increase the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale.

The embedded systems range from portable devices such as digital watches and MP3 players, to large stationary installations like traffic lights, factory controllers, or the systems controlling nuclear power plants. Complexity varies from low, with a single microcontroller chip,to very high with multiple units, peripherals and networks mounted inside a large chassis or enclosure. Integrating features of all thehardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly

advanced ICs with the help of growing technology, the project has been successfully implemented. Thus, the project has been successfully designed and tested.

2.9 PORTABLE RAIN WATER DETECTING ALARM USING IC555 TIMER

The Rain Alarm Project is a simple but extremely helpful project that detects rainwater and immediately sets off an alarm or buzzer. Water is an essential component of everyone's life. It is critical to conserve water and use it properly. Here is a simple project that will sound an alarm when it rains so that we may take steps to collect rainwater and conserve it for later use. We can use the underwater recharge technology to improve the levels of subsurface water by saving this rain water through rain water harvesting.

The Automatic Rain Sensing Alarm Control Circuit may be broken down into three sections. 555 is included in the first part The first part is an Astable Mode IC, the second half is a Comparator LM358, and the third part is a Rain Detector. We utilized a 555 Timer IC for the Astable MULTIVIBRATOR to generate pulses every 2-3 seconds (depending on capacitor value), which implies the 555 Timer IC is configured in Astable mode. The inverting pin of the Comparator

LM358 is directly connected to the output of the Astable Multivibrator. The output voltage of the 555 timer IC is compared to the reference voltage across the comparator's non-inverting terminal, which is set using Voltage Circuit Divider (R3 and R4). One LED was utilized at the output of the 555 Astable circuit, while the other was used at the output of the comparator LM358. Water or rain is detected using a Water Detector or Rain Sensor. The BUZZER receives the output of the Astable Multivibrator and Comparator. Depending on the application, the entire circuit can be powered by a 5V-12V battery.

2.10 SMART RAIN DETECTOR USING AURDINO

Rain alarm project is a simple but very useful project which detects the rain and automatically triggers the alarm or buzzer. The sensor acts like a simple switch where the switch closes when it rains and is normally open when the rain stops. As water is basic need in everyone’s life. Saving the water and proper usage is very important.

This project will trigger the alarm when it rains so we can make some actions for rain water harvesting and also to save the rain water for using it later for agriculture in fields. It is used in automobiles when the detector detects the rain it will automatically activates the windshield wipers of the vehicles. It can also be used in household for

harvesting the rain water and increasing ground water storage instead of flowing it into drainage. So, the main purpose of this project is to prevent the material from rain, can be used in automobiles and in many other purposes. It is an easy and simple reliable circuit which can be constructed at a low cost.

The main idea of the project is to detect the rain fall using the rain sensor and it alerts the person to make some arrangements as in agriculture or in households to harvest the rain water and use it for later purposes. When the rain falls on the sensor it automatically triggers the buzzer and warns the person. As water is the main thing in human life, we must try to save it and use for future purposes. Water is the most precious in our life for living so we must conserve water.

Rain sensor can be made at a low cost and used in wide variety of area like in automobiles as it rains the wind shield wipers automatically switch on in the vehicle, uses in agriculture irrigation as the sensor detects rain it automatically stops the automatic irrigation system in the agriculture, used in household purposes to harvest the rain water and increase the underground water levels for using in future instead of following into drainages.

CHAPTER 3

PROPOSED METHODOLOGY

The proposed method includes the design of the automatic rain shutter and it closes automatically by sensing rain droplets. The figure 3.1 represents the block diagram of automatic rain shutter. The major blocks of the block diagram are Node MCU, Rain sensor module, Synchronous Motor, V8 cable, and adapter.

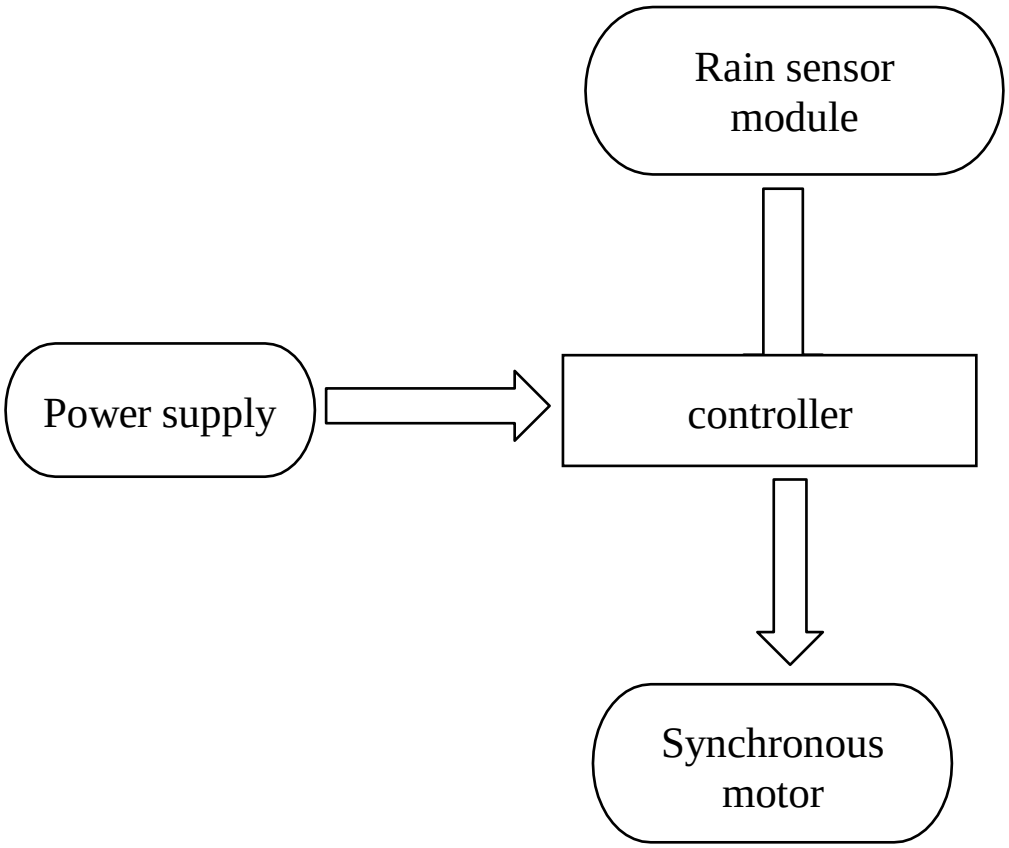

Figure 3.1 Block Diagram of Rolling shutter

3.1 NODE MCU ESP32

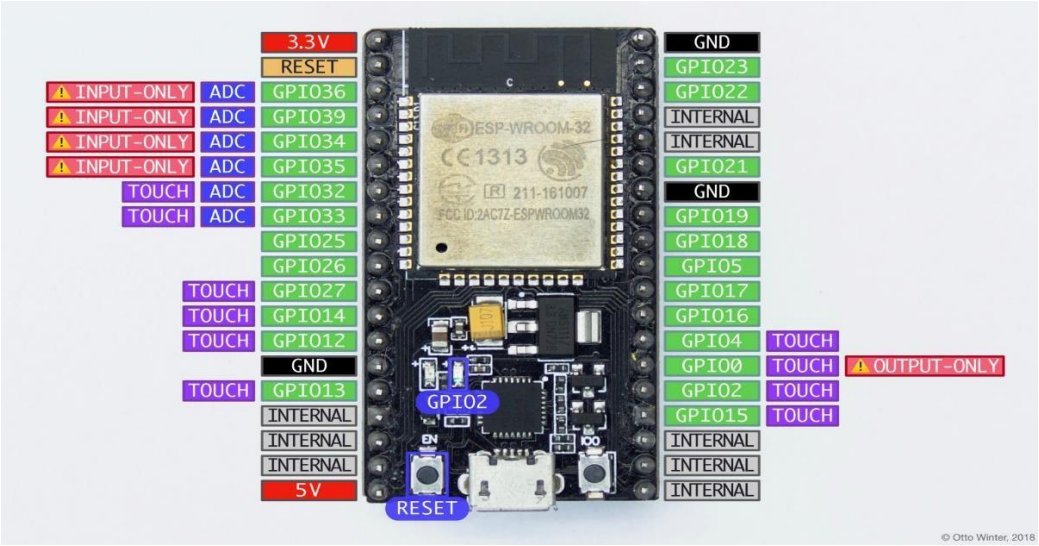

Figure 3.2 pinout of Node MCU ESP32

It adds extra Cores, faster WIFI, more GPIO, and support Bluetooth low energy. The ESP32 has two 8bit digital to analog convertors. The Node MCU is an open-source software and hardware development environment is built around a very inexpensive system on a chip. ESP32 has a total of 34 digital pins. These pins are similar to Arduino digital pins which allows you to add LED display, sensors, buttons, buzzers etc., ESP32 WROOM Module has 25 GPIO pins out of which there are only input pins, pins with input pull up and pins without internal pullups. Maximum current drawn as per single GPIO is 40mA. The ESP32 has three UART PORTS. They are UART0, UART1, UART2, these are compatible with RS-232, RS-485 and IrDA protocols. The ESP32 is possible to use up to 16 pins as PWM outputs where ESP8266 only supports 8 pins.

3.2 SYNCHRONOUS MOTOR

In the rolling shutter, RSM senses the rain level continuously and send the data to the controller, so the motor can operate in both clockwise and anti-clockwise direction. The synchronous motor is capable of operating under either in leading and lagging power factor.

Figure 3.3 Synchronous Motor

The synchronous motor runs at synchronous speed. The motor is controlled by control system receive input signals from the rain sensor. When the motor receives the command to open the shutter, it rotates in a specific direction, transferring the rotational motion, causing the slats to roll up and expose the opening. When the command is given to close the motor, the motor rotates in the opposite direction, which causes the

rolling the shutter, and cover the opening, providing protection against rain and other elements.

3.3 RAIN SENSOR MODULE

The purpose of rain sensor module and relay in an automatic rain rolling shutter is to detect rain and control the operation of the motorized rolling shutter system.

Figure 3.4 Rain sensor Module

The rain sensor module detects the rain, while the relay acts as a switch to activate or deactivate the motor based on the rain sensor's input. Upon receiving the signal from rain sensor, the relay gets activated, so it allows the power to flow to the motor and activates the motor and initiate the

rolling shutter operation. Once the rain has no longer detects the rain or the moisture level decreased below a certain threshold, the rain sensor sends a signal to the relay indicating the rain has stopped. Upon receiving the signal that the rain has ceased, the relay de-energizes, breaking the power supply to the motor control circuit. By integrating the rain sensor module and relay into the automatic rain rolling shutter system, the shutter can respond autonomously to changes weather conditions. It eliminates the need for manual intervention, providing convenience, protection against rain, and efficient operation of the rolling shutter.

3.4 POWER SUPPLY

The motor requires a power supply to open and close the shutter. The rain sensor itself may require the power to operate and sense the changes in moisture or electrical conductivity. The control circuitry, which possess the signals from the rain sensor and controls the motor, also requires the power. Power supply ensures that the rain sensor module is operational and capable of detecting the rain accurately. 12v 5A adapter is used, since the power requirements of the rolling system is compatible, and the adapter is functionally correctly and providing the required voltage and current.

3.5 CONNECTORS

Wiring connectors are used to establish electrical connections between the various components of the system. They ensure proper transmission of signals and power between the Components. Connectors enhance the maintainance and servicibility of the rolling system. If any component needed to be repaired or replaced, connectors allow for easy disconnection and reconnection without disturbing the entire system.

Figure 3.5 connectors

CHAPTER 4

CONCLUSION

The rain sensing automatic rolling system utilizing Node MCU is an innovative and practical solutions for protecting windows and openings from rainwater intrusions. By incorporating rain sensors and the Node MCU microcontroller, this system can detect rainfall and automatically activate the rolling shutters to create a barrier against water entry.

The integration of Node MCU enhances the functionality of the system. The Wi-Fi connectivity provided by Node MCU enables remote monitoring and control, adding an extra layer of convenience and flexibility. The use of Node MCU, an open-source electronics platform based on the ESP32 Wi-Fi module, adds intelligence and connectivity to the system. This automation eliminates the need for manual intervention, providing convenience and ensuring timely protection from rainwater.

The rain sensing automatic rolling shutter system using Node MCU is a reliable, efficient, and intelligent solution for protecting windows and openings from rainwater. The automated rolling shutters ensuring effective water resistance and providing convenience.

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