IoT Based Smart Wet Grinder

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This paper focuses on the integration of Wet grinders and IoT. A wet grinder is one of the common household appliances used in India for preparing the batter, Rice and dhal are the main raw materials used in the preparation of the batter. According to the diagnostic study of the wet grinder at Coimbatore by the Ministry of Micro, Small and Medium Enterprises, about 100,000 wet grinders are produced in India. In the era, where technology and human interacts and where every technology is rapidly enhancing, it is necessary to update the Wet Grinder which is a basic appliance and incorporate this with IoT. Ponmani Power Table Top Tilting Wet Grinder is used and it houses an 180W single phase Induction motor and operates at 180-240V, 50HZ AC power supply. Complementing the Wet grinder with IoT features, such as users can remotely control the power of the wet grinder, a water pump is used to add the necessary volume of water for the grinding process, the motor temperature is constantly monitored and if the temperature rises beyond the safe limit, power is cut off automatically. The timer feature is provided to the Wet grinder, setting automatic power on/off control and the user can control the amount of water pumped into the wet grinder. To incorporate the above features, 2 Channel relay is used to control the wet grinder and water pump which is connected to NodeMCU ESP8266, LM35 is used to measure the motor's temperature. The smart wet grinder is controlled remotely via the user's smartphone using the BLYNK Application. smart wet grinder will empower the homemakers and will give them the freedom to multitask and it will also improve society by reducing food waste.

Keywords: Wet Grinder, Internet Of Things, Future technology,Node-MCU,ESP8266.

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1 Introduction

The Internet of Things (IoT) is a network of things equipped with sensors, applications, as well as other tools that allow communication with other gadgets through the internet. The complexity of these devices ranges from simple private items to advanced technological equipment. According to experts, there will be even more than 1 trillion connected IoT devices by 2020, and 22 billion by 2025. Researchers can connect everyday devices to the internet utilizing embedded devices, including kitchen equipment, smartphones, thermostats, and baby monitors, enabling smooth communication with people, processes, and objects. Physical items may share and collect data without requiring human interaction thanks to low-cost computers, the cloud, big data, analytics, and mobile technologies. Digital systems can record, monitor, and alter every interaction between connected things in today's hyper-connected environment. Physical and digital worlds collide and work together.

Mr P. Sabapathy invented the first electric wet grinder in 1955. A wet grinder is a kitchen device used to make batter for idlis and dosas. It finely grinds food grains with the use of a stone and an electric motor, resulting in a fine paste that is mostly used in Southern India. According to data [1], Coimbatore produces over 75% of India's total monthly wet grinder output of 1 lakh. In 2015, the wet grinder sector had total revenue of over 2,800 crores (US$370 million). In the year 1970, Krishnamurthy and Nanjappan commercially produced the existing electric wet grinder as the Lakshmi grinder, and R doraiswamy launched the Santha tilting wet grinder. After that, ELGI Ultra owner LG Varadaraj commercialized the first table top wet grinder, and this is the most sophisticated and widespread model in the present era. It comes with conical grinding stones and thermal transfer technology, ensuring the richness of the batter. Taking it a step further, this research work satisfies the desire to transform the current one into a future-ready[2] IoT-based Smart Grinder, in which the wet grinder is powered through a mobile application, the entire process is time-bound, and the required water is automatically added according to the user's needs. Additional features such as motor temperature monitoring and auto shut down in the event of high temperature have been enabled to enhance the safety of the IoT based Smart Wet Grinder. The IoT-based Smart Wet Grinder will improve homemakers' safety. Furthermore, it will allow the user to work more freely when using the grinder, speeding up the procedure.

2. Literature Review

2.1 Fifth Gen Control for Industrial Wet Grinders

The designed model is equipped with smart features such as speed regulation, time regulation, temperature regulation, and selection mode[3]. This model reduces the user's work load, and any inexperienced user may effortlessly use this technology. The principal objective of this Smart Wet Grinder control is to enhance grinding efficiency through continuous monitoring and to expand it into the commercial electronics area.

2.2 Diagnostic Study of Wet Grinder Cluster in coimbatore

The Ministry of Micro, Small and Medium Enterprises of the Government of India conducted a diagnostic study to assess the Wet Grinder Manufacturing Cluster in Coimbatore. The study includes specific information on manufacturing units, manufactured parts, total annual production, total annual turnover, and the jobs created by the Wet Grinder Manufacturing Cluster[4]. Furthermore, the report finds that the Wet Grinder Manufacturing Industry has enormous growth potential and measures to improve it.

2.3 Automation of Wet Grinder

The invention focuses on the complete automation of a wet grinder, which eliminates the need for human interaction once the rice is loaded in the grinder. Everything is automated, from the pouring of water to the grinding process to the cleaning of the grinder. Sensors maintain batter consistency, and the finished product is poured automatically into a storage container using the tilting mechanism. This machine can significantly minimize human work while maintaining the quality of the batter being produced.

3 Methods and Components used

3.1 Wet Grinder

For the research, a Ponmani Power Table Top Tilting Wet Grinder with a 180W single phase Induction motor shown in Figure.1 was used. The induction motor runs on an AC power source of 180-240V, 50Hz.

The Wet Grinder measures 37 x 28 x 51.5 cm and weighs roughly 16.5 kg. When grinded individually, this grinder could handle 1kg of rice or 250gms of dal. A 3 pin 5A power cord is used to power the Wet Grinder. The three-pin cord is made up of three conducting wires: Live, Neutral, and Ground, which are color-coded as Red, Black, and Green, respectively. The live wire from the grinder is linked to the relay module's channel 1's Normally Closed End (NC), which regulates the power supply to the Wet Grinder.

Fig. 1: Ponmani Power Table Top Tilting Wet Grinder

3.2 Water pump

A mini submersible water pump is a centrifugal water pump, meaning it uses a motor to drive an impeller that rotates and pushes water outwards. [5]A mini submersible water pump is used to add water to the Wet Grinder during the grinding operation. This is a centrifugal water pump, which means the impeller spins and pushes water outwardly using a DC motor. The water pump is

powered by a battery that provides 5V. The positive terminal of the pump is linked to the Normally Closed end(NC) of the relay module channel 2 and the negative terminal to the battery itself, and so the water pump's operation is controlled. The water pump will be immersed in a water container that is placed next to the wet grinder. The maximum flow rate of the pump is 120 Liters per hour.

3.3 Relay

The 2-Channel 5V Relay Module is a relay interface board that can be controlled directly by a variety of microcontrollers, including Arduino, NodeMCU, PIC, and ARM. The relay is regulated by a low-level triggered control signal (3.3-5VDC). The typically open or ordinarily closed contacts are operated when the relay is activated. It's commonly found in automatic control circuits.The maximum contact voltage of relays are rated at 250V AC or 50DC at 10A and the relay is triggered when the input current from the NodeMCU exceeds 5mA. The relay module has 4 pins that is Vcc, GND, IN1 and IN2. Vcc is the voltage input to the relay module, GND is the ground pin, IN1 and IN2 pins are used to control the relay channel 1 & 2's ON/OFF respectively. The pins IN1 and IN2 connected to D1 and D2 of the NodeMCU board. The relay also features two optocoupler IC which provides isolation between the 2-Channel Relay Module and NodeMCU thus protects the NodeMCU board in case of short circuit.

3.4 NodeMCU

In the corresponding research work ESP8266 is used, Microcontrollers can connect to 2.4 GHz Wi-Fi via IEEE 802.11 bgn using the ESP8266 module. It can be utilized as a self-contained MCU by running an RTOS-based SDK or with ESP-AT firmware to offer Wi-Fi connectivity to external host MCUs. The module comes with a full TCP/IP stack and can process data, read GPIOs, and operate them[6].

The Tensilica 32-bit RISC CPU Xtensa LX106 microcontroller is used in the NodeMCU ESP8266, and according to the data sheet, it has a maximum clock speed of 80MHz (i.e. it can perform 80 million cycles per second). The Arduino IDE software has been used to programmed the NodeMCU. It's wired up to a 5V small submersible pump, a temperature sensor (LM35), a 2-Channel 5V Relay Module, and a power supply, as well as a wet grinder. The controller will be in charge of the entire system.

3.5 Temperature Sensor

The LM35 is a temperature sensor with precession that changes its output voltage based on the temperature surrounding it[7]. It's a compact, low-cost IC that can detect temperatures ranging from - 55 to 150 degrees Celsius.35V and -2V are the minimum and maximum input voltages, respectively. 5V is the most common voltage. The output voltage is directly proportional (Linear) to temperature. The drain current is under 60uA. because of its dimensions it is suitable for remote applications. Apart from this, TO-92, TO-220, TO-CAN, and SOIC packages are also available.

3.6 BLYNK application

Blynk is designed for the Internet of Things. It can control hardware remotely and can display the sensor data as well as it can also store data and visualize it. Blynk is an open-source platform that is used to develop Mobile applications. The Blynk Server opens a bidirectional communication channel with the IoT module. It isolates itself with the unique Authorization Token, allowing transactions from both sides. Blynk is a web-based service.[8] This implies that the gear used should be capable of connecting to the internet. Some boards, such as the Arduino Uno, will require an Ethernet or Wi-

Fi Shield to communicate, while others, such as the ESP8266, Raspberry Pi with WiFi dongle, Particle Photon, or SparkFun Blynk Board, are already Internet-ready.

3.7 Circuit Diagram and working of the proposed system

NodeMCU ESP8266 uses Tensilica 32-bit RISC CPU Xtensa LX106 microcontroller, from the data sheet it is inferred that it has a maximum clock speed of 80MHz (i.e it can perform 80 million cycles per second). The NodeMCU is programmed using Arduino IDE software .[9] The program contains an additional pre-processor directive, that is BlynkSimple8266.h. BlynkSimple is a special library that is used to communicate between the Blynk Application and NodeMCU. BlynkSimple8266.h contains the function Blynk.begin(); which is used to initialize SSID, password of the wifi network and the blynk authentication code to the program and thus connection between the NodeMCU, Blynk server and Blynk application is established. A micro USB cable is used to upload the program to NodeMCU[10]. To continuously send LM35 temperature sensor data to the Blynk application, BlynkTimer function is used. These functions are already included within Blynk Library. The circuit is illustrated in Figure 2 . It consists of NodeMCU, Two channel 5V relay, LM35 Temperature Sensor, Submersible water pump, Wet Grinder, battery and other passive components. [11]The Circuit diagram is drawn using fritzing.

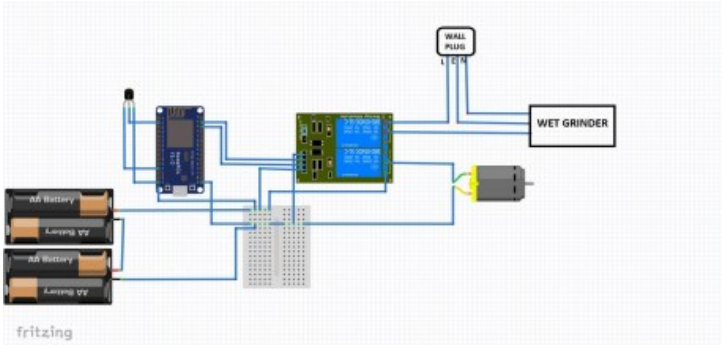

Fig. 2: Circuit Diagram

The Wet Grinder and Submersible water pump's power supply is indirectly controlled by the switch Button Feature in the Blynk Application dashboard via NodeMCU and two Channel Relay. Button 1 which controls the first channel of the relay is assigned to the GP16 Digital pin and Button 2 which controls the second channel of the relay is assigned to GP5 Digital pin.[12] From the circuitry it could be seen that the live wire of the Wet Grinder and Submersible water pump is connected to channel 1 and channel 2 of the relay respectively. When the Blynk Application's Button 1, which corresponds to the Wet Grinder, is switched on, the ON signal are transmitted to the NodeMCU board via Wifi, which then activates the Channel 1 of the relay module, which is linked to the Wet Grinder's live wire and Power supply and thus . Similarly, the Submersible Water Pump corresponds to Button 2 of the Blynk Application. When Button 2 is pressed, the ON signal is sent to the NodeMU, triggering Channel 2 of the relay module, which activates the water pump, allowing water to be pumped to the wet grinder.

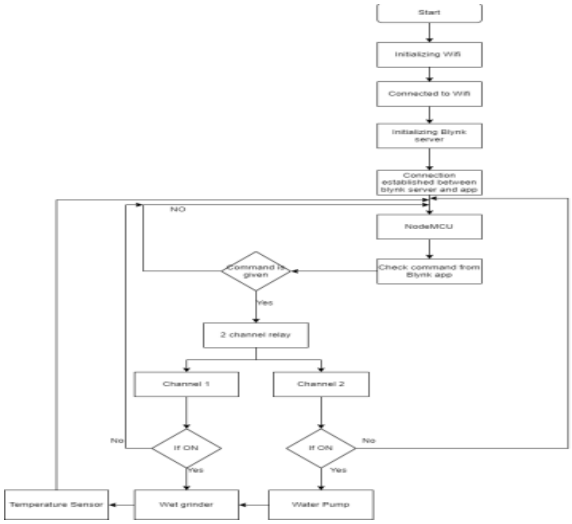

Fig. 3: Flow Chart of the proposed system

The temperature of the motor is continually monitored with the use of an LM35 temperature sensor, and the data is displayed to the user via the Blynk application. The Lm35 is an analogue sensor that generates a voltage proportional to temperature. The analog Read() function is used in the programming to read the voltage value from the LM35 using Node MCU[13]. The reading in celsius is obtained by dividing the voltage output by 1024 and multiplying it by 3300. The method is depicted in Figure 3. The operation begins with the establishment of a wifi connection, after which it will initialize the blynk server, which will enable the connection between the blynk server and the mobile phone application. The controller will supervise all activities; it will check the command given by the user for each activity; if yes, NodeMCU will activate the relay module, which will activate the wet grinder. When it comes to turning off the wet grinder, the same technique will be performed.The wet grinder will be connected to the first channel of the two-channel relay, and the water pump will be connected to the second. The user will be able to send directions through the blynk application. The water pump can be turned on and off according to the order.The temperature sensor LM35 will continually provide input to the NodeMCU controller for continuous temperature monitoring, and if the temperature exceeds the safety limit, it will turn off the relay channel attached to the wet grinder, thus turning off the wet grinder. The timer can be set for a specific period of time using the blynk application; if the time exceeds the time set by the user, the microcontroller will turn off the Wet Grinder thus halting the wet grinder's operation.

4 Results

The proposed approach is simulated using a ponmani table top tilting wet grinder and blynk application tool integrated via the Internet of Things(IoT)[14]. Initially, the out values of each sensor can be verified through the serial monitor. The microcontroller ESP8266 is used, NodeMCU gets the sensor output and it directs the system for further process as NodeMCU enables the wifi a dedicated application is created using BLYNK application(Figure 2) through which the user can remotely control the wet grinder.

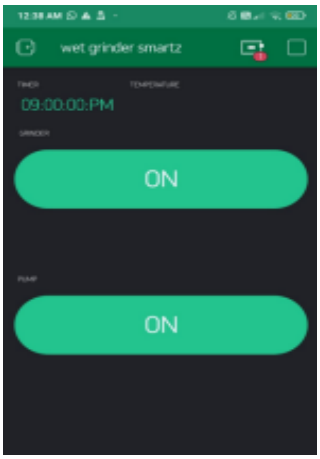

Fig. 4: BLYNK application

The wet grinder is controlled by two channel 5V relay module shown in Figure 4 , the relay module is connected to the nodemcu and powersource through blunk application; a user can easily control the relay thus controlling the turn on and turn off application of the wet grinder[11][10]. The induction motor of the wet grinder is also ultimately controlled by relay and nodeMCU apart from the continuous temperature monitoring is also enabled to enhance safety if the temperature rises beyond the threshold limit the wet grinder will be automatically shut down.

5 Discussion

The wet grinder is an integral element of every Indian household, and improving a wet grinder empowers homemakers. The IoT-based [15] Smart Wet Grinder is the perfect tool for Integrating IoT with everyday household items. BLYNK application is used to incorporate the IoT with the Wet Grinder, blynk is an easy-to-use handy tool to use for application development without deep knowledge in the coding language The IoT-based smart wet grinder can be controlled remotely, has a timer and automatically adds water. It is also a safer, reliable and time-saving tool for everyday kitchen work. In the near future, voice assistant techniques through mobile applications can be added for example google Alexa, amazon echo dot) and automatic grain addition [13] [12] may be introduced to make it more systematic and reliable. Apart from this a piezo buzzer can be added to notify the user.

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