# RFID Controlled Washing Machine: A Literature Review

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***Abstract*- In premises like hostels and other places the residents have to wash their clothes by hand and fail to dry the fabrics properly leading to compromised quality of washing. Implementing washing machines for the public use is a challenging task if everything has to be accounted manually which would lead to chaos and unaudited loss in accounts. Thus, there is a necessity to automate the payment process and also ease the usage for the users. We can realize this solution by implementing Radio Frequency Identification (RFID) controlled Washing Machine by providing access and maintaining accounts. The project basically stands on four components namely: RFID, STM32 Microcontroller, Cloud database and Internet of Things (IoT). RFID which is the first domain is preferred for the project as the identification technology. STM32 Microcontroller is a 32-bit microcontroller board that suits for fast computations and fairly complex problems. The project shows the implementation of a cloud-based database for storing unique identities, payment details and other user data. The fourth domain which is the IoT is the fashion in which the processes are handled and our project requires devices that can connect and interact with other devices over internet.**

***Index Terms*–Washing Machine, Cloud Database, Internet of Things (IoT), RFID, STM32.**

## I. INTRODUCTION

In today's era of automation, the engineers' community has come forth to implement numerous business models involving continuous advancements in technology to make life easier for the society. In the past when automation was still being uncovered, most daily processes around the world required human resources. Completely depending on a third party for handling the processes has both pros and cons. Pros being more human - human understanding, nimble decision making and quicker changes in plans, and so on. And Cons being malpractices in business, corruption, varying efficiency, data and sensitive information security issues and so on. When a more dependable system was required that could render constant efficiency and also ensure good data security a few technological advancements happened for example the use of Radio Frequency identifications (RFID), introduction of Biometrics and other technologies on the same lines. Presently the world has truly come to understand how full-fledged secure systems can be realized using these technologies. These identification and security technologies have entered various avenues such as banking, medicine, IT sectors and also the defense.

To cater to innovation in making hygienic lifestyles easier and safe not just for the student community residing in residencies but also for the general public, implementing a washing machine with automated accounting for ease of use and maintenance with the help of RFID tags and reader would be a viable solution for the above stated challenges.

A centralized account must be set up to which an annual charge is deposited by every resident. All the residents are provided with RFID cards and the washing machines in the washing area are upgraded with RFID readers and an additional control panel. Whilst using the washing machine the resident has to tap the RFID card to the reader, upon successful reading of the card, the washing machine is powered up. The control panel enables the user to set the time of wash and accordingly a fixed amount is deducted from the deposited amount at the centralized account. The panel is sturdy, easy to understand and use thus reducing maintenance risks.

RFID technology [1] has recently gained traction. RFID technology aids in the faster processing of manufactured goods and accounting. RFID allows for verification of identification from a certain distance.

It has taken more than 50 years for RFID to enter the mainstream. The main cause is financial. RFID isn't as inexpensive as traditional labelling technologies, but it adds value and is now at a pricing range where it can be used on a wide scale to manage consumer retail products.

Following the creation of new innovations, there is a significant change in human daily routines as well as working conditions [2] in businesses. As it contains a few jobs, this is becoming a well-known notion across many vertical and opposite needs remembering a normal person's day-to-day existence for the general public. The IoT's development has been largely driven by the needs of large pots, which stand to benefit greatly from the information and sharpness gained from the capacity to track all objects along the ware chains with which they interact. Through IoT, firms have been able to come more successfully, accelerate operations, reduce errors, aid burglary, and fuse difficult and adaptable hierarchical frameworks. The Internet of Things (IoT) is a cutting-edge innovation that tackles the long-term fate of registration and dispatches, and its advancement is dependent on dynamic data. Connecting, robotizing, covering, and commanding are all part of the Internet of Things.

The term "cloud" was coined from computer network [3] principles, which employ it to obscure the structure's complexity. Because of its ease of use, on-demand access to network resources, minimal operating processes, and lower cost, cloud computing is gaining a lot of traction among IT professionals, academics, and individual users. Cloud computing is defined by the National Institute of Standards and Technology (NIST) as a model for enabling universal, on-demand network access to a pool of configurable computing resources such as networks, servers, repositories, operations, and services that can be provisioned and released with minimal operational trouble or service provider relationship. This new cloud computing technology has seen a significant growth in demand, as well as an increase in the number of businesses using it. Its low-cost services, pay-for-use strategy, Cloud nature, rapid-fire supply of computer resources, and provision of a data repository centre with unlimited space and significant processing capability for storing and managing data entice cloud visitors.

The STM32 family of microcontrollers [4], which is based on the Advanced RISC Machines (ARM) Cortex-M3 processor, provides a foundation for creating a wide range of applications with frameworks, from simple battery-powered dongles to complicated constant frameworks like helicopter autopilots. This component family includes a number of distinct designs with a variety of memory capacities, accessible peripherals, execution, and power options. The elements are sufficiently reasonable in small amounts to justify their use for the majority of extremely low-volume jobs. The low-cost esteem line components are comparable in price to the ATMega parts used in the well-known Arduino improvement sheets, but they give far less execution and additional peripherals. The peripherals used are shared across many families, such as the USART modules, which are common to all STM32F1 factors and are supported by a single firmware library.

## II. LITERATURE SURVEY

The primary goal of RFID frameworks [5] is to use labels to identify objects. These labels contain transponders, which use specialised RFID readers to convey messages in a well-organized manner. The majority of RFID labels contain a recognisable proof number, such as a client number or an item's Stock Keeping Unit (SKU) code. A reader receives data about an ID number from a dataset and takes necessary action. RFID labels can also have writable memory, which can be used to store data for several RFID readers in different places. RFID labels are small, wireless devices [6] that aid in the identification of things and people. They will most likely multiply into the billions in the coming years and eventually into the trillions as a result of lower expenses. RFID labels are tracking goods in supply networks and are making their way into consumers' pockets, possessions, and, strangely, assemblages. Researchers' proposals for security assurance and uprightness confirmation in RFID frameworks are examined in this study. The receiving wire plan [7] for passive RFID labels is presented as a sketch. They discuss several requirements for such plans, draw a nonexclusive design cycle that includes range estimating methodologies, and focus on one practical application: RFID tags for enclosing the following warehouses. This application's stacking wander receiving wire layout is shown, along with its other

beneficial viewpoints, such as aversion to the production cycle and box content. Displaying and repeating the results, which are in great agreement with estimation, are also discussed.

RFID has progressed significantly [8] in the last few years, to the point where businesses are supplying exceptional RFID-related challenges. They divide the tests into four categories: mechanical issues, application regions, strategy, and security concerns. Their examination of the papers yielded useful information on RFID usage, which should aid in the generation and gathering of data in this field. The results collected by RFID professionals and specialists serve as inspiration for future study areas. LANDMARC [9], an area detection model framework that employs RFID technology to locate things within buildings. The main advantage of LANDMARC is that it focuses on finding things with greater precision by employing the concept of reference labels. The experiment demonstrates that dynamic RFID is adequate and intelligent for detecting indoor areas. Despite the fact that RFID is not meant for indoor area detection, they raise three critical features that must be incorporated in order to promote RFID and the commercial sector.

One of the ten greatest [10] contributory developments of the twenty-first century has been RFID. This progress has landed in a burgeoning economic sector, with total deals estimated to exceed $7 billion by 2008. RFID is being used by a rising number of excursions to improve the viability of their activities and gain a competitive advantage. Supply Chain Management (SCM), the health-care business, and security challenges emerge as major examples in RFID as a result of the audit. Likewise, the RFID business's obligations and measurements of inventive instances were studied, with the conclusion that RFID will soon be a part of everyday life. The Auto-ID Center is considering low-cost RFID-based systems with the primary application of next-generation scanner labels. They represent RFID development, describe their approach and research, or, more broadly, they depict the evaluation of RFID entryways for cryptography and information security professionals. The common issue in low-cost RFID architectures is that estimate resources are limited, and all components of the RFID system are linked together. Understanding these associations and the consequent arrangement compromises is critical to successfully detecting the security and assurance difficulties in low-cost RFID structures.

RFID is a vital component of modern living. It improves [12] usability and flexibility. It is used in applications such as preventing vehicle and item theft, collecting tolls without effort, maintaining traffic, gaining access to structures, automating halting, controlling vehicle access to gated networks, corporate grounds, and airports, administering stock, giving ski lift access, following library books, purchasing burgers, and fostering an entryway to follow an overflow of assets in inventory network board. RFID development is also being organised for usage in the United States Department of Homeland Security, with applications such as line convergences and multi-reason compartment shipments while dealing with commonly safe activities. RFID is a radio technology that transmits essentially advanced information between a fixed region and a convenient thing or between flexible articles over a short distance. The more complicated contraptions come with more features and are frequently linked to a host PC or organisation. RFID applications have used radio frequencies ranging from 100 kHz to 10 GHz.

RFID advancements could boost the potential benefits of storing the network on the board by reducing stock occurrences, increasing cycle efficiency and speed, and increasing information precision. By combining different labels, readers, and frequencies, different RFID systems can be created. The cost and potential benefits of each arrangement vary significantly. To reduce the influence on shop network execution, a top tier on RFID advancement courses of action in supply secured is supplied. There are numerous types of RFID [14], but at the most basic level, RFID devices are divided into two categories: Active and Passive. Dynamic labels require a power source, which can be either a charged source or energy stored in a battery beneath the surface. In the last option, a mark's lifetime is restricted by the amount of energy set aside, which is balanced against the number of read errands the gadget should complete. The transponder attached to a plane that distinguishes its public takeoff is one example of a functional tag. There is no need for a power supply for latent labels. They don't have the ability to use it to its full potential. The use of Fastags in vehicles is an example of a detachable RFID model.

IoT is a fashionable articulation of Information Technology [2]. The Internet of Things (IoT) aspires to combine everything in reality under a single system, providing not only control over the things around us, but also keeping us informed about their status. They are concerned with the definitions, origins, basic requirements, characteristics, and names of the Internet of Things. The main goal is to provide a blueprint of the Internet of Things, plans, and crucial headways, as well as their applications in everyday life. The Internet of Things (IoT) sets a limit for people and PCs in terms of acquiring and collaborating with billions of things that include sensors, actuators, organisations, and other Internet-connected objects. The acceptance of IoT structures will allow for foreseeable integration of the sophisticated world with the real world, as well as fundamentally alter and draw in human interaction with the world. The system, which is generally described as an item structure expected to be the agent between IoT contraptions and their applications, is a critical development in the affirmation of IoT. The thorough review of the problems and enabling improvements in developing an IoT framework that recognises the variety of IoT devices while also maintaining the key components of connectivity, adaptability, and security. IoT, which will [16] create a massive network of billions or trillions of Things communicating with one another, is facing a variety of technical and application hurdles. This article discusses China's IoT progress, covering methodologies, R&D initiatives, applications, and standardisation. This study portrays such problems on development, applications, and standardisation from China's perspective, and also suggests an open and general IoT design with three phases to handle the plan problem.

Because the consequences of IoT dissatisfactions [17] might be absurd, auditing and investigating security vulnerabilities in the IoT is more important. The primary goal of IoT security is to provide insurance, protection, and assurance of the security of IoT clients, structures, data, and devices, as well as to assure the openness of businesses presented by an IoT climate. As a result of the obtainable enjoyment instruments, modellers, and computational and examination stages, IoT security study has gotten a lot of traction. The most important task is to draw a diagram showing the present state of IoT security research, as well as the most important instruments, IoT modellers, and test frameworks.

Food security has become a key issue for most countries as a result of the combination [18] of decreasing normal supplies, limited availability of developing areas, and expansion in uncertain environmental conditions. As a result, IoT and Data Analytics (DA) are being employed to improve the agriculture region's practical competence and productivity. From the use of Wireless Sensor Networks (WSN) as a major driver of shrewd agribusiness to the use of IoT and DA, the situation has shifted. WSN, RFID, Cloud Computing, IoT structures, and end-client apps are all examples of existing innovations in the IoT. The organic IoT architecture, as well as the combination of IoT and DA, is enabling brilliant cultivation at its best. The IoT has developed as an area of incredible influence, promise, and development, thanks to the technique of brilliant homes [19] and intelligent urban places. They are more vulnerable to assaults than other endpoint devices such as phones, tablets, and computers. Despite shows employed for frameworks organisation, correspondence, and the board, the prevalent security difficulties concerning the IoT layered plan are really serious. The security needs for IoT are dictated by threats, hazards, and state-of-the-art plans. The prevention of IoT security risks is also critical for existing programmes. More significantly, the manner that square chain, which is the secret development for bit coin, might be a major engaging affect in dealing with numerous IoT security concerns, is noteworthy.

By 2020, more than 25 billion devices will be connected [20] through remote exchanges. Low Power Wide Area (LPWA) headways have become noticeable, as seen by the rapid improvement of the IoT sector. Narrowband (NB) and Long Range (LoRa) are two main progressions in various LPWA technologies. It is critical for partners to have a thorough understanding of NB-IoT and LoRa as powerful plans. Unlicensed LoRa clearly has advantages in terms of battery life, cutoff, and cost. Approved NB-IoT, on the other hand, provides features like as QoS, torpidity, uncompromising quality, and reach. IoT anticipates the total blending [21] of a few objects while utilising the Internet as the foundation of the correspondence system to create a fantastic correspondence. The cloud, as the

foundation of IoT, allows for massive application express companies in a variety of application domains. Various IoT cloud providers are currently developing in the industry to employ appropriate and unmistakable IoT based companies. IoT cloud stages take into account a variety of organisational spaces, including application progress, device leaders, system leaders, heterogeneity leaders, data leaders, and instruments for assessment, planning, noticing, insight, and inquiry. The entire spread of IoT fogs is evaluated based on its relevance.

The Internet of Things (IoT) refers to the connectivity [22] of smart devices in order to gather data and make informed decisions. The lack of natural safety attempts renders IoT defenceless against security and protection threats. Block chain, with its security by design, can assist in meeting critical security requirements in the IoT. Block chain capabilities such as immutability, transparency, auditability, information encryption, and functional flexibility can help address most IoT design flaws. The following are some of the intriguing aspects of the related work: (i) it covers various application areas, sorting out the available writing according to this arrangement, (ii) it presents two usage models, namely, device control and information for executives (open commercial centre arrangement), and (iii) the development level of some of the introduced arrangements.

The Internet of Things (IoT) is a new technology that has revolutionised [23] the entire association of individuals, brilliant devices, research articles, information, and data. The Internet of Things is still in its early stages, and many clearly linked challenges must be resolved. The Internet of Things (IoT) is a concept that binds everything together. IoT provides a unique opportunity to increase the world's receptivity, trustworthiness, openness, adaptability, and characterisation. The cornerstone for improving IoT is structure security. The affirmation and blend of heterogeneous clever contraptions, as well as Information and Communications Technology (ICT), are the cornerstones of the concept. IoT network security, IoT online assurance designing and logical classification, essential engaging countermeasures and systems, critical applications in efforts, research examples, and challenges are all covered in this stream.

Open server ranches can provide a number of benefits, including the ability to run software [24] and manage data on machines connected to the internet. Regardless, applications require some sort of stage to run in any environment. This stage usually consolidates a working structure, some data management approach, and possibly more for on-premises applications, such as those running inside an affiliation's server ranch. Cloud-based applications have very comparable setup requirements. The advancement of Cloud registration paved the way for massively parallel computational systems [25] to be used in a wide range of applications. As additional cloud providers and innovations emerge, analysts are faced with the unyieldingly difficult task of evaluating various contributions, such as public and private fogs, and deciding which model to adopt for their applications' requirements. They discover a show evaluation of two and private cloud stages for practical enlistment. They dissect the Azure and Nimbus fogs, taking into account all of the key requirements for dependable applications (estimation power, limit, data moves and costs). The evaluation is carried out with the use of both specified benchmarks and a real-world application.

Microsoft Azure is a generic brand name for Microsoft's cloud computing services [26]. It encompasses a vast, and more importantly, developing, range of organisations that frequently shape the fundamental components of Cloud registration. If you're reading this, you're probably an IT pro with some basic Azure knowledge. Despite the fact that Azure is a relatively new cloud provider, it has amassed enormous quantities of money in a short period of time, organised by capacity and commitments. Today's cloud models rely on each server running its own frameworks organisation stack to carry out tasks like as virtual association burrowing [27], security, and weight shifting. Providing these stacks on CPUs eliminates the need for VMs, increases the cost of running cloud services, and adds slowness and changeability to the execution process. They demonstrate Azure Accelerated Networking (AccelNet), a system that uses proprietary Azure SmartNICs based on FPGAs to offload host frameworks organisation to gear. They depict AccelNet's goals, which include programmability that is virtually indistinguishable

from programming, as well as execution and efficiency comparable to gear.

Microsoft Azure Machine Learning (ML) [28] is a tool that enables an architect to create prudent examination models (by preparing information from a variety of data sources) and then successfully provide those models for usage as cloud web businesses. From simple authorization to common data sources, rich data examination and discernment gadgets, and utilisation of popular ML calculations, Sky Blue ML studio provides rich ease to assist various beginnings with complete work process situations for generating farsighted models. In Cloud computing [29], one goal is to assign (and pay for) just those cloud assets that are truly needed. Until now, cloud specialists have relied on plan-based (e.g., season of the day) and rule-based systems to automate the matching of calculating requirements and processing resources. They present a methodology in which the primary determining components are virtual machines (VMs) of various sizes and costs, occupations are represented as work processes, clients determine execution requirements by allocating (delicate) cutoff times to occupations, and the goal is to ensure that all positions are completed within their cutoff times at the lowest possible cost. They achieve this goal by effectively distributing/deallocating virtual machines and scheduling errands during the most cost-effective times.

The normality of IoT [30] is rapidly increasing, with a rising impact on our daily routine. As of now, IoT has garnered a lot of attention in both academia and industry, and there have been critical investigations of IoT security and security components, as well as advanced genuine systems. Novel access control models and frameworks for IoT have been developed by academic researchers. On the commercial side, corporations such as Microsoft, Amazon, and Google have provided Cloud-Enabled IoT Platforms to enable widespread data collection. With the rapid advancement of Cloud registering [31], an ever-increasing number of adventures will reconsider sharing their sensitive data in the cloud. To protect the typical data mystery from untrustworthy cloud expert associations, one popular method is to keep only the encoded data on the cloud. The core difficulties of this system are implementing access control for encoded data and disavowing client entry independence when it is not usually supported to access encoded data. The purpose of this study is to address both of these difficulties.

Cloud computing has advanced tremendously [32], notably in the area of business online applications. The on-demand, pay-as-you-go model for enrolling resources is a flexible and practical strategy. As a result, it's critical to assess the performance of High-Performance Computing (HPC) applications in current cloud conditions in order to understand the trade-offs that come with shifting to the cloud. This is the most comprehensive examination to date, distinguishing traditional HPC stages from Amazon EC2, and using verifiable applications representative of the requirement at a typical supercomputing facility. Various standard language architectures [33] have tried to stress clarity within the confines of expressing a large number of defined rules. For example, in an internet-based media site, feeling evaluation frequently looks for a large number of unequivocal terms and their reciprocals. These structures then count the times those words are co-arranged with a brand in a comparative articulation, minus any additional evaluation of the setting in which those words are being employed. It's possible that the system will overlook the fact that the evaluation isn't about the IBM Donut Store. Natural Language Processing (NLP) is the name given to this concept since, despite the fact that it is extremely meticulous in its tighter concentration, it isn't breathtakingly precise.

Current battery-powered devices [34] combine low-power, recently developed microcontrollers that perform OS-less programming and are usually reprogrammed at the factory. However, it is possible to add new functionality to the device while also making bug repairs, and one should guarantee that the device can be easily recreated while being used by the end user. A Nordic NRF51 Bluetooth module is linked to the STM32 microcontroller from STMicroelectronics. The goal is programmed using the on-chip boot-loader. The two chips are linked by a DC-DC support converter, which provides the typical power supply. The information collection [35] used on the site is a critical essential innovation in the robotization industry to ensure item quality and normal operation of the production system. Information procurement innovation has become more common in industry as data innovation has

progressed. In the realm of modern automation, rapid, continuous information acquisition is critical. A/D chips are becoming faster, and information procurement frameworks are requiring faster transfer speeds. Traditional interchanges are constrained by slow sending rates, a weak opponent of sticking capacity, and will be replaced by USB, the new age Universal Serial Bus. With a better understanding, one might discuss the advantages of the Universal Serial Bus (USB) and the need for an information security framework in light of USB.

There is very little useful [35] work about the execution of the Generalized Predictive Control (GPC) technique on miniaturised contraptions like Field Programmable Gate Arrays (FPGA) and microcontrollers in the compositions. The advancement in the field of new structures and understanding application conditions on a GPC operated on an STM32 microcontroller to manage a principal second solicitation system can be credited to the clarification. To conduct a presentation assessment using the GPC, a Proportional, Integral, and Derivative (PID) controller can be used in the STM32.

Model Predictive Control (MPC) [37] is logically being recommended for developing applications to provide diverse contraption checking, and it has turned into an indisputable level development example of embedded innovations. The goal of perceptive estimation is to use the top-of-the-line display processor STM32 to continually control a warm structure. The control estimation is obtained by executing the MPC in this cutting-edge standard hardware, which employs Kiel enhancement gadgets designed for ARM processor-based microcontroller devices. A comparison of test results reveals that the MPC estimation outperforms the PI regulator in terms of ampleness and advantages. Fluffy PID controllers can be used to regulate the development of two-wheeled robots [38]. The fleecy PID controller combines a feathery controller with PID controllers to change and improve the distance of a two-wheel changing robot. For the robot's change, the soft controller is set up using association models. The robot's situation is under the control of the PID controllers. Using an STM32F4 Discovery Kit, the entire feathery PID may be ported and executed on a continuous functional structure. The STM32 microcontroller provides a potential foundation for implementing [39] Generalized Predictive Control (GPC). The STM32 Keil starting unit can be programmed via JTAG, and the STM32 board may also be used to run the proposed GPC firmware. Aside from the GPC, the PID hostile to windup estimation was also carried out with Keil improvement gadgets designed for ARM processor-based microcontroller contraptions and employing the C/C++ programming language. Between the two firmwares, a presentation evaluation study was conducted. The emphasis in these lectures is on demonstrating exceptional execution speed and low computational weight.

The STM32 family of micro regulators, based on the ARM Cortex M3 [4] processor, provides a foundation for creating a wide range of installation frameworks, ranging from simple battery-controlled dongles to complicated continuous frameworks, such as helicopter autopilots. This part family has a variety of distinct configurations that provide a wide range of memory sizes, accessible peripherals, execution, and power options. The parts are sufficiently inexpensive in small quantities, costing only a few dollars for the most basic devices, to justify their use in most low-volume applications. For easy to moderate applications, a truly basic Nucleo-64 [40] board could be useful. By presenting the Nucleo configuration as sheets appropriate for creative project use, STM has truly acknowledged the creator community. These sheets are quite inexpensive, usually about US$10–15, which leads me to believe that STM is attempting to gain traction in the creative community by actually supporting the sheet assembly costs. Understanding rapid control prototyping [41] devices that can save time, money, and effort in the control plan is critical. The microcontroller STM32F4 is the subject of investigation. In dynamical frameworks, the auxiliary aim is to concentrate on model-following control. Two applications on a DC engine speed and position control can be used to achieve this goal. To achieve these goals, the present task follows a logical path to the previous goal. The model-following regulator is also discussed, starting with the fundamental control requirements for readers who are unfamiliar with the subject.

The STM32 essential controller can be used in the [42] sophisticated sensor data acquisition system, reducing costs and headway cycles. Above all, the

packaging of the mentality sensor is represented to get system, according to the layout necessary. Similarly, the hardware circuit makes a decision. The important circuits are shown, which connect the MPU6050 circuit and the STM32 interface circuit. Then, using Keil programming, develop the STM32 driver programs, and create the host PC programs using the CVI virtual stage.

## III. METHODOLOGY AND MODEL PROPOSED

Based on the literature survey on various domains including Cloud, IoT, RFID and STM32 microcontroller we came with suitable technologies to build the RFID Controlled Washing Machine from Scratch. Passive Reader Active Tag (PRAT) type of RFID setup shall be used in the project. PRAT readers do not require any power supply to do its functionality. 125 KHz frequency range tags are used as this band do not require any special permission or any regulation verification. This RFID reader is interfaced with the STM32F103CBT6 Minimum System Board Microcomputer to hard code the data into the reader. Cloud connection between the microcontroller unit and the server is achieved by interfacing a Global System for Mobile Communications (GSM) module. The working model of the tender put forward spins around the supreme service in the real time environment and at the same moment, it is reliable and user friendly and is completely built on STM32 microcontroller unit interfacing with RFID module along with cloud server. RFID module is used to give access to the user to utilize the washing machine module for washing purposes.

RFID Reader module is used at the fixed module near the washing machine to read the passive RFID card given to the user. A relay module is connected to the MCU unit to control the power supply given to the washing machine. A cloud server which is connected to the STM32 microcontroller unit where in STM32 acts as the client for receiving and transmitting the user data and fetching balance from the client's account. Once the clearance is received from the cloud server, the STM32 microcontroller unit activates the Real Time Clock (RTC) and sends a signal to the relay to provide the washing machine with the power supply. Once the RTC reaches its given time, STM32 microcontroller unit again sends a signal to relay to cut down the power supply given to the washing machine unit. Each and every user shall be given an RFID card and an individual account to keep track of their usage and also to maintain their card balance. The figure shows the basic block diagram of the RFID controlled washing machine.

The block diagram of RFID Controlled Washing machine in the figure 1 shows the functionality of the RFID controlled Washing Machine. RFID cards act as the input for the entire system to function. Once the RFID cards are read by the RFID readers, it sends a signal to the microcontroller unit.

Upon reception of the signal from the RFID reader, the microcontroller activates both the relay as well as the real time clock. Relay makes the circuit close and activates the power supply which is given to the Washing Machine. Real time clock keeps track of how long the power supply is to be given.

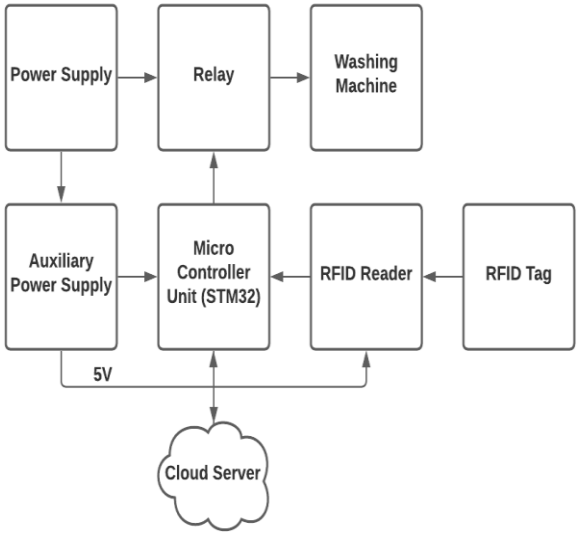


**Fig 1.** Block Diagram of RFID Controlled Washing Machine.

Once the RTC reaches the given time it gives a signal to the controller unit. Upon reception of the signal from the RTC microcontroller unit deactivates the relay and makes the circuit open. Hence the power supply given to Washing machine is cut down. Auxiliary power supply is given to microcontroller unit to keep track on the timing when the main power supply is shut down.

## IV. CONCLUSION

RFID controlled washing machine is one of the resource optimized solutions for controlling the chaos

of manpower and also to take care of the audits effectively. The paper explains the RFID, Cloud, IoT and STM32 microcontroller technologies which are used in setting up a complete RFID controlled washing machine in a premise. This IoT project utilizes the Passive Reader Active Tag (PRAT) kind of RFID setup interface with STM32 microcontroller board along with Cloud Connectivity to maintain the proper user database and to provide access to make use of the machine. This project results in successful maintenance of the washing machine setup by providing access only to the registered user with enough balance to make use of the machine to wash fabrics keeping them clean and tidy. However, it is very essential to keep our fabrics tidy in order to maintain a good and healthy lifestyle.

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