Automated E-Ration Distribution System

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Abstract —*Mainly India's Public Distribution System (PDS) is one of the largest retailer system in the world. Its motto is to provide food security to the people and this is achieved by providing food grains at subsidized rates. Public Distribution System provides a ration card that is issued under the authority of state government for the purchase of essential consumer materials like rice, wheat, kerosene, sugar, oil etc. Considering the present scenario, this paper gives the proposed system i.e. "Automated E-Ration Distribution System" which follows a complete Automatic process from billing and distribution of food grains and this leads to reduction in corruption and illegal smuggling of goods and brings full proof of validation, flexibility and the transparency into the PDS system.*

Keywords: Public distribution system, ARM7, FingerPrint sensor, LCD display, Node Mcu module, Telegram, Load cell, Keypad, Dc motor etc.

I. INTRODUCTION

In India, the government's primary functional system is the Public Distribution System, with a total of almost Fair Price of 5.5 lakh government ration shop. According to the survey, this program is solely responsible for providing food grain and oil supplies to more than 45 crore Indians living below poverty (BPL) at subsidized rates and for remaining people above poverty line (APL) at a concise with fixed rate. Consequently, the BPL population is designed to obtain high subsidy prices for the rationed food grains while the APL population gets the ration at open market or wholesale rates without retail.

A. Existing system

Grain leakage in the current PDS system: The Leakage of grains happens in the PDS in two ways. One is, the leakage due to the ration drawn through ineligible and fake cards. The other happens during the distribution. The over allotted grains are diverted when it is transported from the FCI(Food corporation of india) go down to the wholesale go down to the Fair Price Shops. The grain leakage does not stop at the FPSs.

B. Misclassification and corruption

According to the planning commission state report, it is found the total number of genuine BPL families in Karnataka is 44 lakhs as opposed to the Government's claim that there are 96 lakh families. This means 52 lakh families who actually belonged to the APL category are included in the BPL list prepared by the government and are given subsidies on the ration 5.8 lakhs BPL families are exempt from the existing planning committee of the year from the subsidized PDS, of which 4.2 lakh are misclassified as APL and 1.6 lakh have no cards. The materials to be rationed is manipulated in quantity via inaccurate weigh bridges and placing magnets or extra weigh plates, fooling the consumer during the process

C. Proposed system

It mainly stipulates the eradication of few of the shortcomings of current system, regarding commodity leakage and monitoring , the system uses automatic weight monitor using a load cell and any discrepancy regarding the bulk food grain can be monitored and fault can be corrected by real time database management of the FPS environment ,consisting of the shopkeeper, consumer, bulk and ration quantity disposed and remaining, vigilance manager and lastly the time taken for every deposit, every ration amount dispensed is drastically reduced.

Misclassification is caused by the huge amount of paper trail hoarding generated by the current record system; in general, human error is more probable and time-consuming process to debug than a software record entry of the proportion. Corruption is axiomatically the result of this unreliable record keeping system. Using a NODE MCU (ESP8266) module-based automation results in immediate feedback to both the customer and the shopkeeper, the amount transacted and remaining along with direct entry into the log as proof serves as the basis of the framework

proposed. To identity scam using any remaining loopholes is eliminated using a fingerprint sensor which is biometric proof that a individual exists and has already been identified by the government with him/her as an BPL/APL consumer. Automation with stepper motors and conveyor mechanism provides the solution, is time-saving and can be operated efficiently with any microcontroller for grain and oil dispensation.

The proposed concept is to replace the manual work in public distribution system therefore using an automated one which helps in fulfilling the objectives put forward. Also connecting the system at the ration shop to a central database (provided by government.) via NODE MCU WFI module for interaction of customers and the automated system through messaging in telegram platform thus preventing corruption.

II. OBJECTIVES

The aim of the project is to develop an efficient, automated mechanism of ration distribution with a system which incorporates an easy human interface along with the security for preserving individual identity. The main objectives are as follows:

1. Support-government collusion and the private sector by the use of anelectronic framework

2. To build an effective dispensing device using stepper motor and dc motor with a input from load cells for precise calculation of product numbers.

3. The addition of a biometric authentication element fingerprint sensor) in the verification and transparency framework.

4. Display and assess m's precision is additionally associated with the timing.

5.To use NodeMCU module operation based TELEGRAM app, build and analyse the accuracy of the dispensing content,real-time storage monitoring and warnings to FPS and application.

6. Notification of the amount dispensed to the user and the FPS holders, correct human interface using i n p u t keypad and output LCD monitor.

7.Creating comprehensive FPS(Fair price shop) and State-level statistical results.

8.These objectives help in creating the automated system for ration shops which replaces the manual work that helps in eradicating several problems for government and customers.

III. METHODOLOGY

The proposed model uses an ARM microcontroller to examine the numerous articles and publications on the drawbacks of current PDS, both in policy studies and autonomous projects presented in academic papers. The articles containing statistical data on budgetary grants and planned versus real budgets were analyzed in order to get a better view of the aforementioned automation. To get a transparent system with the consumer and the dealer, the model consists of working principles of notification via text message; hence a NodeMCU Wi-Fi module is incorporated.

The LCD model consists of working notification concepts via text message to achieve a straightforward program between the user and the seller, thus integrating a Node MCU V2 element. The LCD monitor is for the human user interface which shows notifications for the gain which work of the customer at any phase in the procedure. A biometric fingerprint sensor which is matched is used for the verification purpose with the stored database. The dispensing mechanism for the said automation, two stepper motors with bipolar rotation are used which dispense the food grains to the container attached to the load cell. The feedback from the load cell stops the stepper motor and the DC motor handle turns the container to dispense the collected grain.

Kerosene is also included in the system for practical reasons; wheat and rice grains are used as necessities. ARM LPC2148 is used as it is low power easily programmable and includes two UART serial features needed in this project. Upon each process, the data obtained provides the total sum of grain stock in any FPS in a day. The findings collected come from the 3 leaders with store database of phone numbers and fingerprints. Each transaction's time and accuracy are noted for statistical purposes.

In hardware the USB cable connects the software to the microcontroller .The software used is KEIL uvision5, from which embedded C programming code is flashed onto the microcontroller. The results obtained show the average accuracy of the working of the prototype model, considering the time and usage factors.

IV. BLOCK DIAGRAM

The ARM LPC2148 microcontroller is the heart of the device as can be shown in the block diagram seen in fig , and operates on a controlled 12 V power supply. The Node MCU module, LCD and fingerprint reader works with the microcontroller's integrated C programming required by the proposed framework. The fingerprint module checks fingerprints of authorized users if present in the database, then the NodeMCU Wi-Fi module sends a confirmation message to start the process of dispensing material.

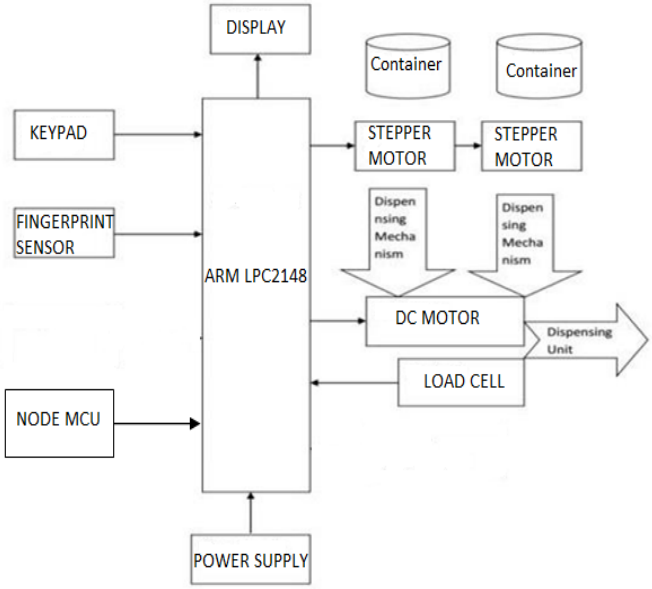

Fig-1: Block diagram

Through using the 4pin keys, the user selects the amount of food grain required and the stepper motor begins the shutter process, which releases the food grains. The load cell feeds the quantity to the microcontroller and the microcontroller orders the stepper motor to stop at the same time as the DC motor attached to the load is delayed, load cell with a plastic container attached rotates by a measure of 90- degree hence emptying the contents in a bowl which belong to the user.

A. Arm Microcontroller

It includes of 32 kB of on-chip static RAM and 512 Kb of on-chip flash memory.128-bit wide interface/accelerator enables high-speed 60 MHz operation. Single flash sector or full chip erase in 400 ms and programming of 256 bytes in 1 ms .10-bit ADCs provide a total of 6/14 analogue inputs, with conversion times as low as 2.44 µs per channel. Multiple serial interfaces including two UARTs (16C550), two Fast I2C-bus (400 Kbit/s), SPI and SSP with buffering and variable data length capabilities.

Fig-2: ARM LPC2148

B. LCD and KEYPAD

The device is operated using a basic LCD module with display of 64 characters spread over 2 lines. The computer is low powered by a simple programmable interface that is available everywhere, with inexpensive and durable designs. Having just 14 contact pins in all, it shows the step-by - step program run on few screens. Commands are quick and easy to understand

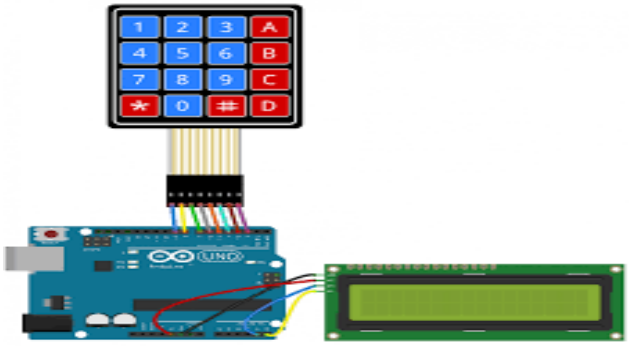

Fig-3: Keypad and LCD

The keypad used is a basic 4 key setup and is used by the consumer to enter the choice of ration and the amount of ration. The keys are analogue and the board has 3 pins, namely transmitter, power and ground. It is fast, sensitive and efficient for low cost. The keyboard takes the input and sends it to the microcontroller with almost no delay.

C. Biometric authentication

The system as a whole requires both individual defense, and security is required at some level for the network. Person protection is employed with a biometric identification sensor or a fingerprint sensor in this case.

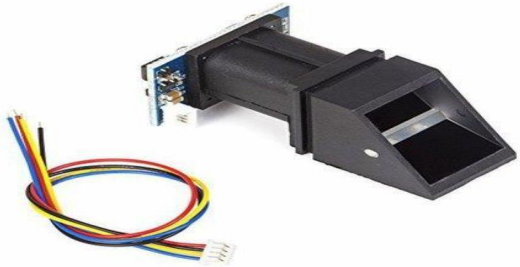

Fig-4: Fingerprint sensor

It deals with pre-programmed codes for authentication success or failure. It has very less response time of 1.3 seconds, (includes searching and acquiring). It comprises of inbuilt buffer and inbuilt storage for more than 100 fingerprints for authentication and it is programmable with ARM LPC2148 after driver installation. Fingerprint processing includes two parts: fingerprint enrolment and fingerprint matching (the matching can be 1:1 or 1: N). When enrolling, user needs to enter the finger two times. The system will process the two-time finger images, generate a template of the finger based on processing results and store the template. When matching, user enters the finger through optical sensor and system will generate a template of the finger and compare it with templates of the finger library. For 1:1 matching, system will compare the live finger with specific template designated in the Module; for 1: N matching, or searching, system will search the whole finger library for the matching finger. In both circumstances, system will return the matching result, success or failure. It operates on DC power: 3.6V-6V and the Current working rate is 100mA-150mA. The Time taken to acquire: <0.5sec and the Average searching time: <0.8sec.

D. NODE MCU(ESP 8266) MODULE

This is open-source, Interactive, Programmable, Low cost, Simple and Smart WI-FI module .It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espress if Systems, and hardware which is based on the ESP-12 module is suitable. The firmware uses the Lua scripting language.

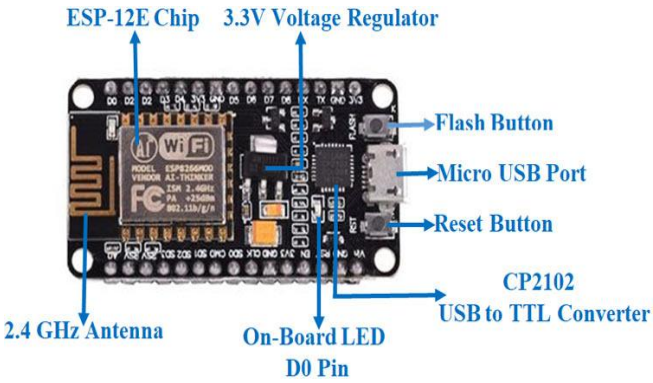

Fig-5: NodeMCU

E. Telegram Communication

Telegram is a cloud-based instant texting and voice over IP administration. It rolled out for Android in Alpha on October 20; 2013.It is a cloud-based messaging app like Whatsapp, which is more open, safe, secure and private. Telegram helps to communicate with contacts. All messages sent by telegram can be encrypted easily removed or removed. Files of size up to 1.5 GB can be send, all the media can be stored in the cloud.

Before using the Telegram application, Telegram Bot Father (Robot) is first prepared; its function is to facilitate the process of making chat or moderation applications within the Telegram itself.

An Internet Bot, otherwise called web robot, WWW robot or essentially bot, is a product application that runs computerized errands (contents) over the Internet .The IoT platform of the NodeMCU devkit v1.0 board is used by creating a server for our chat Bot in Telegram. This server will determine the anticipated response of our Bot in a specific command or chat of a user that chats with our Bot.

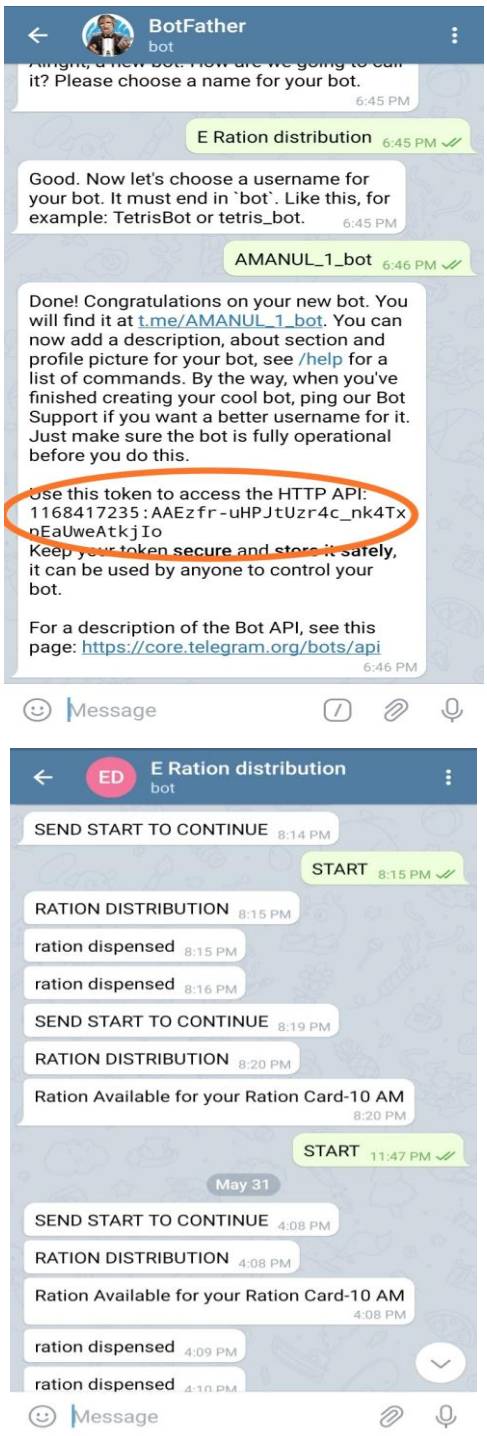

Fig-6: Server creation

F. Load Cell

The straight bar load cell (also called a strain gage) will turn into an electrical signal up to 5 kg of pressure (force). Each charging cell can calculate the electrical resistance which changes in response to, and proportional of, the strain applied to the bar. With this gauge we will be able to tell just how heavy an object is, if an object's weight changes over time.

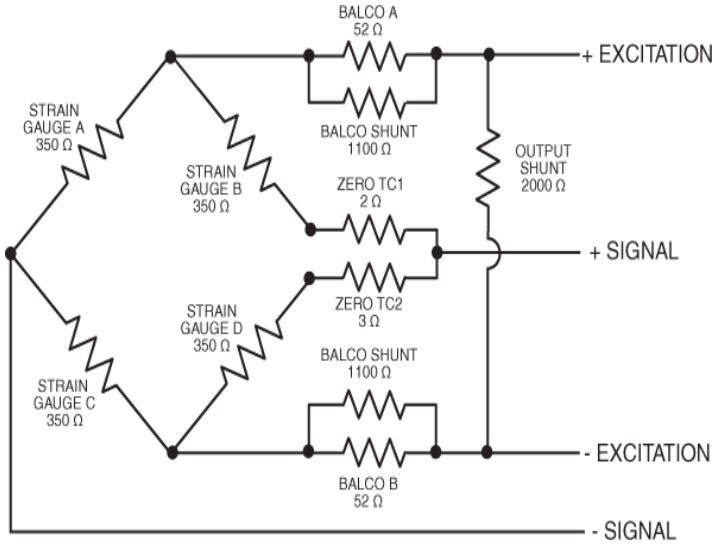

Fig-7: Load Cell

G. KEIL Software

The µVision5 IDE is a Windows-based software development platform that associates a robust editor, project manager, and makes facility. µVision5 integrates all tools including the C compiler, macro assembler, linker/locator, and HEX file generator. The µVision5 IDE offers plentiful features and advantages that help us quickly and successfully develop embedded applications and also help you achieve our design goals.

The µVision5 interface includes a command input menu bar, a control bar where we can easily pick command keys, and windows for source files, dialog boxes, and µVision5 allows to open and view several source files simultaneously. M Vision5 has 2 modes ofoperation:

- **Build Mode**: Allows us to translate all the application files and to generate executable programs. The features of the Build Mode are described under Creating Applications.

- **Debug Mode**: Provides us with a powerful debugger for testing your application.

V. CIRCUIT DIAGRAM

The controller circuit consists of ARM LPC2148, Node MCU module, fingerprint reader, MAX232 UART, LCD panel, and DC motor load cell attached as seen in Fig 4.1. GPIO pins P0.0 to P0.15 are used for TX LCD panel (data lines), ARM microcontroller TX, RX fingerprint reader lines, load cell and read / write pins. The load cell is

attached to the DC motor which after feedback from it rotates back and forth 90 degrees with a delay of 50ms.

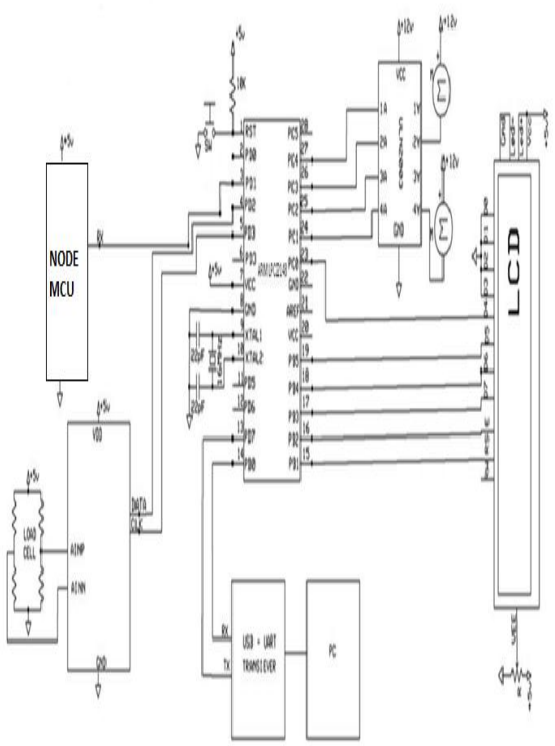

Fig-8: Circuit diagram of the system

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VI. FLOWCHART

The flowchart represents the entire working of the project from selection to dispensing of the food grains as

Shown in fig. Then the program relays back to the initial position of scanning the fingerprint. The consumer is then asked to choose the type of wheat, rice and kerosene content that is entered through the keyboard.Further the quantity is needed 80/100/120gms.After quantity collection the dispensing process is initiated using stepper motor and transmission subway. In the plastic bowl connected to the load cell and DC motor, the ration content is stored. When the load is matched, the feedback shuts down the stepper motor and DC motor rotates to the side by an angle of 90 degrees to empty the plastic bowl into the consumer utensil. With the support of connected Node MCU module a notification SMS is sent to the customer. Giving information about how much is dispensed.

The user scans the finger with the fingerprint sensor and if the id is presents the program proceeds with the password matched.

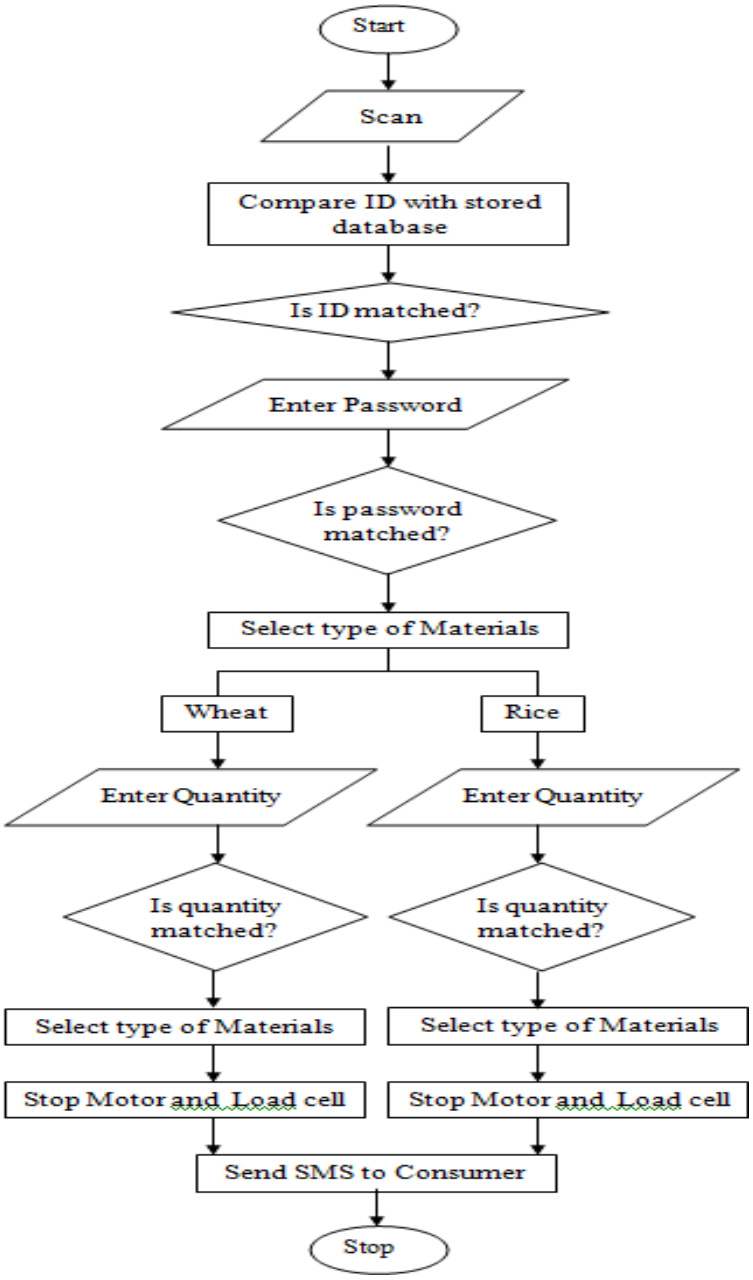


Fig-9: Flow chart

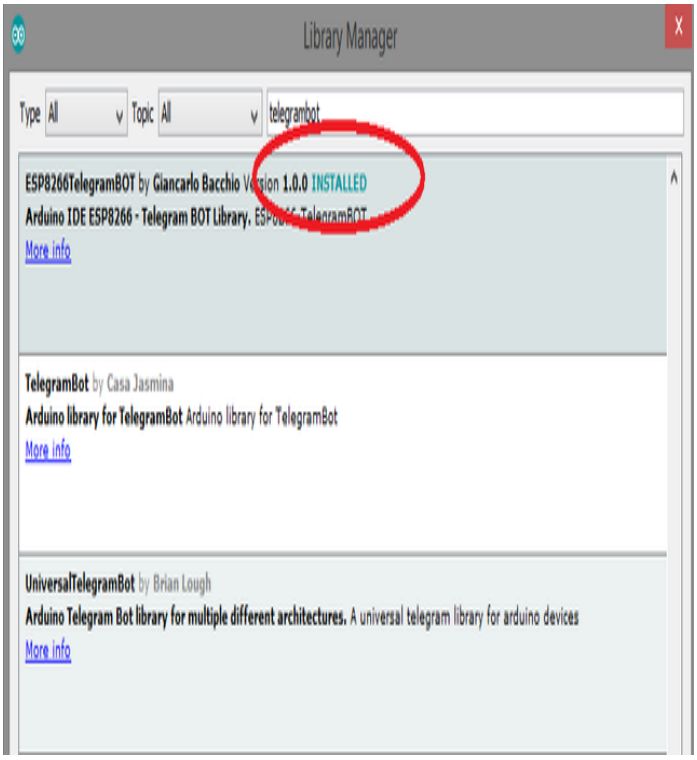
VII. ALGORITHM TO PROGRAM NODE MCU MODULE

Step1: "Programming the Board"

When we have finished downloading and installing the necessary files to run ESP8266 boards like the NodeMCU devkit v1.0 board, it would be required to close the Arduino IDE then, open it after a minute. It is good practice to do, so as to allow the new libraries to be loaded for setup when you open the Arduino IDE again, in some instances to avoid errors. After, go to **Tools** tab and change the board to Node MCU 1.0 (ESP-12E Module).

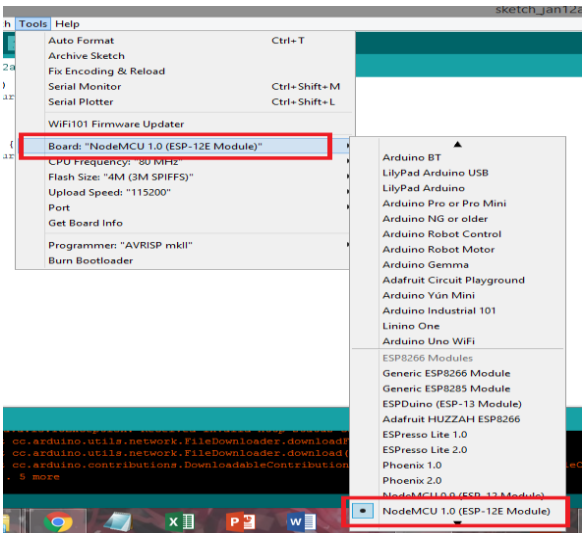
Step2: Open Arduino IDE then, check if you have the ESP8266 library from your installed libraries .This is necessary to configure the Node MCU to run on Arduino IDE.

Step3: go to **Sketch** tab and click on **Include libraries** > **Manage libraries**. And search for the ESP8266Telegram Bot library and install it.



Step4: After, go to **Tools** tab and change the board to Node MCU 1.0 (ESP-12E Module).

Step5:"Create a Web Bot Server using Node MCU devkit v1.0 board via Telegram".



VIII. CONCLUSION

The project basically consists of three modules that operate together, firstly the Fingerprint package; the ARM microcontroller controls the LCD unit and the NODE MCU WIFI module. The tension regulator controls the power supply necessary. Switching to the circuit requires the NODE MCU module to check for activation and tests network coverage, if the WIFI is right, the system will start and the message will be received to the consumers that the prototype is ready to use. LCD displays the messages and fingerprint is used to authenticate the registered user, the choice to proceed and select the amount of food grains is entered by the consumer via 4pin keyboard. The designed device is expected to be medium in scale and has a 1 ft x 1.5 ft. cardboard dimension and hinges make up the support frame and laminated thermocol boards are used for the pump, dispensing assembly, stepper motor-controlled shutters. The device is upright with the ARM. Control board mounted on the rear of the frame .The proposed system is mainly designed to be affordable with cost not exceeding Rs 13000 and serves as an example of automation proposal for ration material discharge for the government. The project is aimed at reducing corruption and food grain wastage in the current PDS system that creates needless problems for both government and consumers, thereby saving taxpayers ' money and ensuring enough food for the poor and vulnerable.

XI. FUTURE SCOPE

- As all systems have a beginning and through technological advancements and statistical results only can it can develop and grow, the

proposed system has a very bright scope for the future. Following are the few methods of improving the system:

- Using an IOT database with the help of severs and MYSQL to setup a live portfolio of each customer, which can be accessed by user id/phone no. OTP like IRCTC website.
- Developing an android application for the same with similar link to the government server.
- Dynamic tracking of the amount of food grain in every FPS and with a feature of transferring grains from one shop to the other in case of high demand.
- Attaching a conveyor belt to accompany the high demand, as the shops are always overcrowded, also, using state of art IR sensors for accurate feedback of grains dispensed.
- The system can be used in shopping complexes and supermarkets to automate the process and sell items without human intervention.
- It can be used in ration processing factories and organizations for simultaneously weighing and packing of items which are intended for selling

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