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IoT Based Remote Monitoring and Controlling for Shutter Systems

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ABSTRACT

The technological advancement of the current technology has affected the processes of the most of the economic and social related businesses. The aims of this advancement are to serve and make human life more comfortable and however, there are still lots of areas in our daily life where manual processes are used. Taking as an example in the water control and management systems, where many authorities use manual systems for water controland management. Especially nowadays most of the countriesare still using manual system for controlling and monitoring the dams. Due to the complicated and time consuming process in a manual system, a model for Remote Monitoring and Controlling of Dams is proposed that uses remote control technology, linked to the web technology, to attain great success in monitoring and controlling water levels in managing dams. This paper is to present a new solution which it is to implemental proposed system called as RMCD "Remote Monitoring and Controlling of Dams". With the proposed system it will allow the user to control and monitor the dams remotely which it is saving a lot of efforts, reducing the cost and also increasing the monitoring quality as the users are going to use automated system rather than using of manual system.

Keywords: automation, flood gate, arduino uno, level sensor, flow sensor, gsm, pH sensor, rain drop sensor

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I. INTRODUCTION:

Water resources in India include information on precipitation surface and groundwater storage and hydropower potential. India experiences an average precipitation of 1,170 millimeters (46 in) per year, or about 4,000 cubic kilometres (960 cu mi) of rains annually or about 1,720 cubic meters (61,000 cu ft) of fresh water*per person* every year. India accounts for18% of theworld population and about 4% of theworld's waterresources. One of the solutions to solvethe country'swater woes is tocreate Indian RiversInter-link Some 80 percent of its area experiences rains of 750 millimeters (30 in) or more a year however, this rain is not uniform in time or geography, most of the rains occur during its monsoon seasons (June toSeptember), with the north east and nort receiving far more rains than India's west and south, other than rains, the melting of snow over the Himalayas after winter season feeds the northern rivers to varying degrees. The southern rivers however experience more flow variability over the year. For the Himalayan basin, this leads to flooding in some months and water scarcity in others. Despite extensive river system, safe clean drinking water as well as irrigation water supplies for sustainable agriculture is in shortage across India, in part because it has, as yet, harnessed a small fraction of its available and recoverable surface water resource. India harnessed 761 cubic kilometers (183 cu mi) (20 percent) of its water resources in 2010, part of which came from unsustainable use of groundwater. Of the water it withdrew from its rivers and groundwater wells, India dedicated about 688 cubic kilometers (165 cu mi) to irrigation, 56 cubic kilometers (13 cu mi) to municipal and drinking water applications and 17 cubic kilometers (4.1 cu mi) to industry and the standard norm for domestic water usage in India is 135 liters per capita per day, prescribed by the Central Public Health and Environmental Engineering Organization. According to Central Pollution Control Board (CPCB) of India, about 500 billion cubic meter water out of the total available fresh water is used in industries annually, out of this, about 10 billion cubic meters water is used by processing industries and 30 billion cubic meters is used for Refrigeration purposes. India has 18% of world population, having 4% of world's fresh water, out of which 80% is used in agriculture.

India receives an average of 4,000 billion cubic meters of precipitation every year.

However, only 48% of it is used in India's surface and groundwater bodies...

Fig1. Newspaper clipping of the Larji Dam disaster

Dams can also provide a lake for recreational activities such as swimming, boating, and fishing. Many dams are built for more than one purpose; for example, water in a single reservoir can be used for fishing, to generate hydroelectric power, and to support an irrigation system. Water-control structures of this type are often designated multipurpose dams. A dam can be a central structure in a multipurpose scheme designed to conserve water resources on a regional basis, multipurpose dams can hold special importance in developing countries. Where a single dam may bring signifi cant benefits related to hydroelectric power production, agricultural development, and industrial growth.

II. EXISTING iSYSTEM

It represents that motors are controlled automatically by using audrino and sensors. This model of gate control system of Dam is the completely automated by using audrino and can control the level of the dam gates using backup of the water. The level of water in the dam is controlled effectively there by opening and closing the gates of the dam whenever the level increases. Therefore the use of Programmable logic control has opened doors for a level of automation according to the signal from the sensors, other applications of this system are automatic water flow in dams under emergency condition, household applications, and industrial applications, water supply for villages in developing world, pond water management and water transfer.

III. Literature survey

1. xavier Litric Robust IMC Flow Control of SIMO Dam River Open-Channel Systems, 'IEEE Transactions on Control Systems Technology.

This paper deals with the automatic control of a dam river system, where the action variable is the upstream discharge and the controlled variable the downstream discharge. The system is a cascade of single input single output (SISO) systems, and can be considered as a single input-multiple output (SIMO) system, since there are multiple outputs given by intermediate measurement points distributed along the river. A generic robust design synthesis based on internal model controller (IMC) design is developed for internal model based controllers. The robustness is estimated with the use of a bound on multiplicative uncertainty taking into account the model errors, due to the nonlinear dynamics of the system. Simulations are carried out on a nonlinear model of the river.

2. Syed Muhammad Umar Talha, Syed Hassan Ahmed and Mansoor Ebrahim, 'Design for Irrigation and Monitoring System of an Automated Dam'

In this paper explain the industry has always focused to devise engineering methodologies for establishment and modification of relatively easier Controlling and Automation methods for any scrupulous process and this presents the design and implementation of a control system by means of microcomputers and data transmission networks, to verify the principle operation of the Controlling design be presented a miniature Automated Dam model is experimentally tested using a PC-based system.

3. Swapnil Bande , Prof. Dr. Virendra V. Shete 'Smart flood disaster prediction system using IoT & Neural Networks'

Floods are the natural disasters that cause catastrophic destruction and devastation of natural life, agriculture, property and infrastructure every year. Flooding is influenced by various hydrological & meteorological factors. and number of researches have been done in flood disaster management and food prediction systems. However, it has now become significant to shift from individual monitoring and prediction frameworks to smart flood prediction systems which include stakeholders and the flood affecting people equally with help of recent technological advanceme nts.Internet of Things (IoT) is a technology that is a combination of embedded system hardware and wireless communication network which further transfers sensed data to computing device for analysis in real time. Researches in direction of flood prediction have shifted from mathematical models or hydrological models to algorithmic based approaches. Flood data is dynamic data and non-linear in nature to predict floods, techniques such as artificial neural networks are used to devise prediction algorithms.

4. S Vara Kumari, O Sailaja, N V S Rama Krishna, Ch Thrinisha' Early Flood Monitoring System using IoT Applications'

This paper represents the development of flood monitoring system using the platform of Thing speak application for storing and retrieving data from the systems using the HTTP protocol over Local Area Network. This system is based on one NodeMCU board integrated with the Thing speak application. Firstly, a NodeMCU is placed in the flood prone areas where the NodeMCU acts as the transmitting unit which consists of an ultrasonic sensor that is used for the detection of the water level at the time of floods and then the data is displayed through the LCD. Now the data collected by the ultrasonic sensors will be passed to Thing speak web application. In order to find the rate of flow a water flow meter is used which writes the flow rate to the Thing speaks application. Thing speak stores data in private channel by default, but there is an opportunity to share data among the public by using the public channel. Thus the result obtained shows the designed system is capable of monitoring the flood prone areas.

IV. PROPOSED SYSTEM

In this project audrino controller is the heart of the project, located at the centre of the block diagram and controls all the

operations of the system which operates manual and automatic mode. Data were collected from sensors and take immediate action to flood control system Also operate and control the flood manually shutter open and close system. An LCD is used to display all the operations going on inside the microcontrollerfor the weather monitoring wireless sensors are used to measure various parameters like level sensor, pH sensor, over flow sensor, rain fall sensor. All sensors are connected on the audrino controller and the status of the sensors is sent to the control section periodically every 3 minutes. The parameter values can be updated on internet by using IOT and can be displayed locally. These parameters can be used as inputs to certain mathematical models to predict about the possibility of floods by dam open and close system.

V. SYSTEM ARCHITECTURE

Our proposed system is represented in the block diagram shown below in Figure 2.

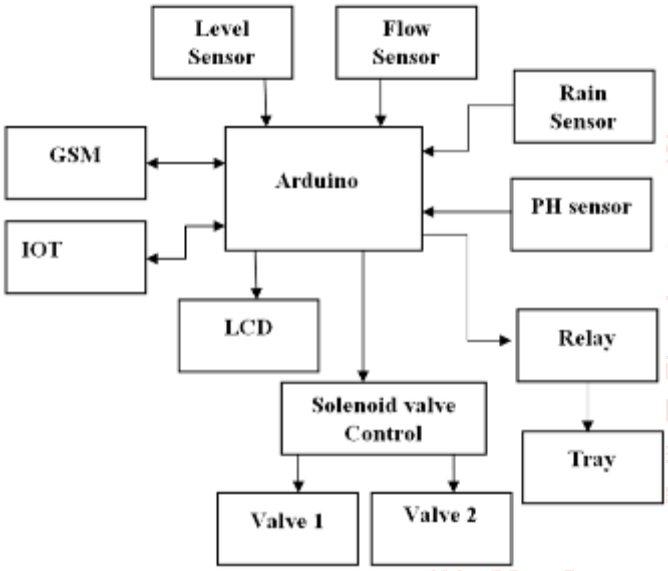

Fig2: Block diagram of proposed system.

Here we have made the system by using plc over IOT. At the first stage of design a water level sensor is used for sensing water level accurately. Raspberry pi is used to control the overall system automatically that reduces the design of system and control complexity. Raspberry pi takes input from the sensor unit which senses the water level through level sensors. When water level rises or decreases then the sensor circuit triggers the plc.

A. PROPOSED HARDWARE

The major components that this paper describes are as Follows:

1. **ARDUINO UNO***:* The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button, it contains everything needed to support the microcontroller; simply connect it to a computer with a USB cableor power it with an AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2programmed as a USB-to-serial converter. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduno, moving forward.

Fig2: Arduino uno board

2. **Floodgates actuation**: Floodgates are adjustable gates used to control water flow in flood barriersand reservoirs. F100dgates generally enclose the water in the reservoir, giving them a one-way,open/close passage to the spillways. Once freed, the water drops from the height dictated by the damconstruction and allowed to fall on the turbines; thereby converting the potential energy (mgh) of falling water with mass m at a height h, into rotational energy through the turbines. The rotation of the turbines is then responsible for generating DC (dynamos) or AC (alternators) power through the principle of electromagnetic induction. The actuation of floodgates is implemented with PLCs,wherein the ladder program takes care of controlling the opening and closing of the floodgates as and when needed, or following interrupts that may occur in the program operation sequence. Thisis beneficial also because the response time of the system controlled by PLCs usually range within microseconds to milliseconds. For practical implementation of this project, we intend to use gate actuators, interfaced with the PLC- like the AWMA bulkhead with actuator system.

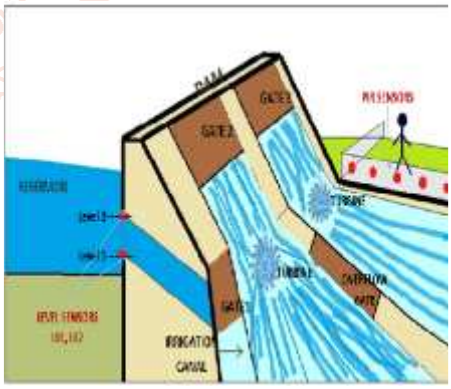

Fig3: Schematic of proposed system

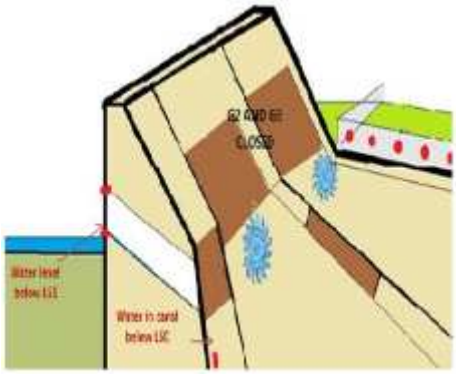

Fig4: No operation of dam

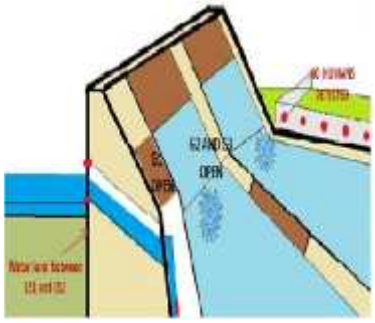

Fig5: Flood gate open to meet irrigation and power generation requirements

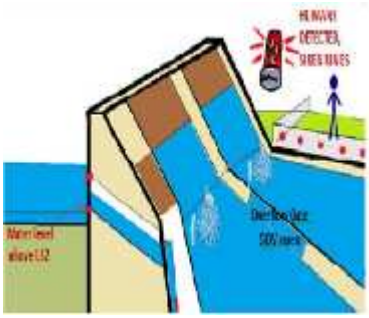

Fig6: Action of flood gate when human presence is detected by gsm module

3. **Level sensors:** Standard level sensors that can be interfaced with PLCs are used to sense the level of a liquid. The sensor consists of a lightweight float suspended at the liquid level that moves vertically with changing water levels. The raising of the float -that is mechanically attached to a level switch on the other end- above a certain height, trips thelevel switch. Thus, when the water level rises above a preset height, the level switch trips to give logic 0 and when the level is below the preset height, the circuit is complete and results in logic 1 which is the default state of the sensor. In this proposal, we make use of three sets of level sensors for the three floodgates of our simulated dam model, using such mechanical sensors allows quick response of the level switches that are represented in the ladder program, in response tochanging water levels in the reservoir and irrigation canal sections of the dam.

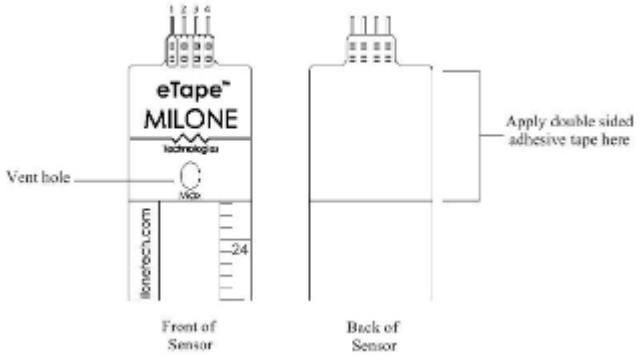

Fig7: Level sensor

4. **PH Sensor**: A pH meter is a scientific iinstrument that hydrogen ion nativity in water-base isolutions, indicating its acidity or alkalinity expressed as pH. The pH meter measures the difference in electrical potential between a pH electrode and a reference electrode, and so the pH meter is sometimes referred to as a "potentiometric pH meter" is the difference in electrical potential relates to the acidity or pH of the solution.[3] The pH meter is used in many applications ranging from laboratory experimentation to quality control.

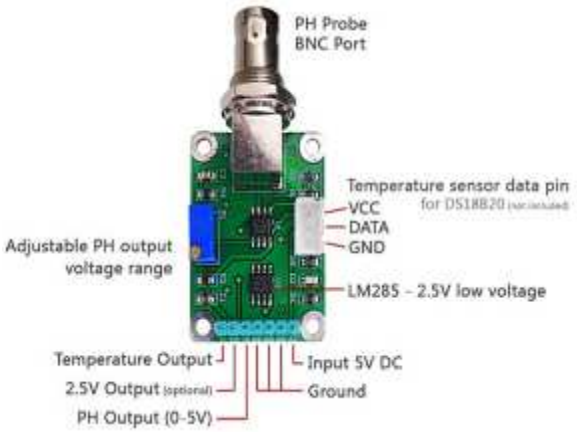

Fig8: PH sensor

5. **Rain fall sensor:** Nowadays, conserving water as well as its proper usage is essential in everyone's life. here is a sensor namely rain sensor which is used to detect the rain and generate an alarm. So, we can conserve water to use it later for different purposes. there are several methods available for conserving water like harvesting, etc using this method we can increase the level of underground water,these sensors are mainly used in the fieldlike automation, irrigation, automobiles, communication, etc. This article discusses a simple as well as reliable sensor module which can be available at low cost in the market.

Fig 9: Rain fall sensor

6. **Flow Sensor:** When water flows through the rotor components, magnetic rotor rotating, and Speed along with the flow of a linear change. Hall element output Corresponding pulse signal feedback to the controller, the size of the flow of Water by controller judgment; adjust proportional valve control of electric Current. Water flow sensorfundamentally solve the differential water-gas valve flap Type high pressure and start water valve easy disoperation appear dry and Shortcomings. it has reflected sensitive, long service life, action quick, safe and reliable, joins convenient traffic advantages such as the start low, deeply the general User affection.

Fig10: Flow sensor

7. **Liquid crystal display (LCD):** LCD is a type of display used in digital watches and many portable computers. Lcd utilize to sheets of polarizing material with a liquid crystal solution between them. An electric current passed through the liquid causes the crystals to align so that light cannot pass through them. LCD technology has advanced very rapidly since its initial inception over a decade agofor use in lap top computer achievements has resulted in brighter displace, higher resolutions, reduce response times and cheaper manufacturing process

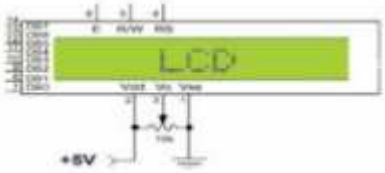

Fig11: Liquid crystal display

8. **GSM:** The GSM system is the most widely used cellular technology in use in the world today, it has been a particularly successful cellular phone technology for a variety of reasons Including theability to roam worldwide with the certainty of being able to be able to operate on GSM networks in exactly the same way - provided billing agreements are in place.

B. PROPOSED SOFTWARE:

PROGRAMMING: The Arduino Uno can be programmed with the Arduino software select "Arduino Uno from the **Tools > Board** menu (according to the microcontroller on your board). For details, see the reference and tutorials. The ATmega328 on the Arduino Uno comes preburned with a boot loader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol you can also bypass the boot loader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header; see these instructions for details. The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available. The ATmega16U2/8U2 is loaded with a DFU boot loader, which can be activated by: On Rev1 boards: connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2. On Rev2 or later boards: there is a resistor that pulling the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode. You can use the ISP header with an external programmer (overwriting the DFU boot loader). See this user-contributed tutorial for more information.

Automatic (Software) Reset: Rather than requiring a physical press of the reset button before an upload, the Arduino Uno is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2/16U2 is connected to the reset line of the ATmega328 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino software uses this capability to allow you to upload code by simply pressing the upload button in the Arduino environment this means that the boot loader can have a shorter timeout. As the lowering of DTR can be well-coordinated with the start of the upload. This setup has other implications. When the Uno is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the boot loader is running on the Uno. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data. The Uno contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It's labeled "RESET-EN" you may also be able to disable the auto-reset by connecting a 110 ohm resistor from 5V to the reset line; see this forum thread for details.

C-PROGRAMMING: We used BASCOM - 8051 software as the integrated development environment for writing micro controller code in the C language. Fig. 8 signifies the flowchart of the operation of the system in AUTO mode i.e., the role of the microcontroller in the system. In AUTO mode the operation of dam gate is controlled by microcontroller. Accordingly the operation in AUTO mode is clearly explained in the flowchart. In this mode the highest level of water is assumed to be 4ft and the lowest level to be 3ft according to our model. Whenever the water level reaches the highest level (4ft) then the controller will open the gate and water level will decrease and as soon as it reaches the lowest level (3ft) the controller will close the gate.

VI. FLOW CHART:

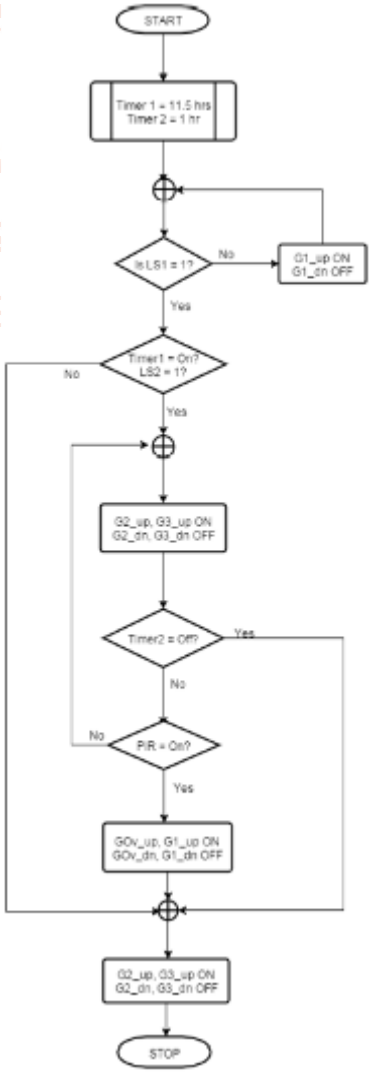

Fig12: Flow chart with algorithm implemented.

VII. DISCSSION

During the implementation of this system there a few problems happened. However, we still succeed to fulfill the objectives that mention before. One of the problems is wireless sensor network topology. We managed to implement cluster tree topology using Xbee S1 pro version but there are still have some limitation because of the devices are built for peer to peer , and not built in the context of mesh network thus the device not suitable implement in a large network. Besides that, this system also needs to upgrade the user interface design to make more interactive and also user-friendly to end user. Collection data using advanced sensor is needed to ensure get a high accuracy of data Measure. The system needs to collect a variety of data that can be used in future for analysis it is useful for developing an intelligent system in future such as prediction, and autonomous system.

VIII. RESULTS

The system we proposed has been successfully implemente D and observed the results. We found that the time taken for the dam gate to open and close is accurately synchronized with the increase or decrease in the water level because of the use of Low Speed High Torque DC Reduction Gear Motor having 100 rpmdue to the use of GUI operator control panel the dam gate can be opened or closed at any time as and when we require which increases the system reliability and flexibility. Fig. 9 shows the operator control panel and graph is plotted continuously on the panel indicating the change in the water level every second which makes the system operator friendly and reduces his job of continuously monitor the water level in dam.

IX. CONCLUSION

The mechanism of dam gate control reduces the water wastage ensures efficient use of available water resources and generates more precise and accurate results. There is no requirement of human laborers for monitoring the level, just one operator is sufficient for opening and closing the gate according to sensor output. Due to the number of sensors doing more we can open or close the dam gate whenever necessary know the accurate level of water. Also operation execution time is less also there are heavy load shedding problems in the villages in almost all states of India. So this dam gate control system operation can be combined with the operation of the geothermal and nuclear power plants for generation of electricity.

X. FUTURE WORKS

Since wired technology is used in our proposed system there is scope to further modify it by using wireless RF technology. Thus the communication between the controller and the driving element can be established wirelessly and improvements can be made with minor changes in this model by eliminating the operator and providing the complete control to microcontroller (automatic level control). It can be used for level monitoring and control in industries. Control of irrigation dam and other large dams used for power generation and water supply should be different; as control of both types together will be very complex since there are total 5200 dams (approx.) in India. Therefore a major future work can be possible in which a centralized control of all the dams in a state using GPRS or other wireless technology under central government can be beneficial to the whole country.

XI. ACKNOWLEDGEMENT

Thanks to my supervisors Dr.M.Muthuviayagam who gave me this opportunity to do this great project on “IOT BASE REMOTE MONITORING AND CONTROLLING FOR SHUTTER SYSTEMS” which also helped me in doing a lot of things and came to know about so many new things I am really thankful to you.

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