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Universal Analog Measurement with Remote Distance

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ABSTRACT: Remote Measurement is very useful in present scenario of multitasking world. Everyone wants there work easy as possible. This method of analog measurement is basically by analog meter by using digital component Arduino Uno. As we all know in Electrical System safety is very important factor, by using this method of measurement or we can say by applying this Universal Analog Instrument in Electrical Substation workers can safely measure the electrical parameters. All these things can be possible by Programming and Execution which we did in Smartphones, Laptop etc. Due to Smartphones, Laptop the electrical measurement is getting easier, so that for this instrument we prefer it. Our project is also applicable on existing analog instruments in substation. The connection and working are easy and understandable. It is having low Installation and maintenance cost. In present day, it can be used majorly in high voltage substation where digital meters are rarely uses as compare to Analog meter due to there drawbacks. Handling of our system is easier for all so that it can reduce the increased unemployment rate due to automation requiring high skills.

KEYWORDS: Universal Analog Measurement, Meter Reading Page, MPU6050 Gyro and Accelerometer Module, Blynk Application, Bluetooth Module, Wi-Fi Module.

I. INTRODUCTION

At the time of DC or at present time of AC and HVDC, Electric shock is always a big factor as Electrical drawback. Peoples invented so much things to reduce this problem and such things are presently using in various Electric fields. To prevent the electric shock all are taking safety precautions. In every electrical industry safety measure is very important parameter. Whenever worker visit any substation for maintenance, measurements or any other purpose, safety shoes and safety helmet must be wearing for his safety purpose. But think if we not need to go near the live system for measurement, then the major problem of electric shock can be reduced or we can say shock probability will be less. Today we measuring various electrical parameters by Analog Instruments such as Voltmeter, Ammeter, and so on by going near to it which can be dangerous in high voltage areas. Also, if any person is working in substation, and he wants to take meter reading so he needs to go near to instrument so his load of work will be increased. Suppose he take reading from his cabin by just one click of smartphone, now his load of work will be reduced and the taking measurement become easier.

By this project, all above things can be possible. In this project, the typical analog instrument is modified or we can say added some more connections. Aim of this project is to safe ourselves from electric shock and take readings of all electric parameters safely. Arduino UNO showing the main role in this project. By using Arduino UNO, electronics components will work to get required outputs. MPU6050 Gyro and Accelerometer is a component required to measure angle along X, Y and Z axis. The spreadsheet or a paper used to make table of parameter values for respective angle which give a proper measurement. This measurement will get in our mobile, Laptop etc. so that the better safety we get. Our Project is mostly applicable in High Voltage Substations because there we can't use digital meters due to its drawbacks so this project is showing important role there.

In this world of SCADA System all measurements are automated. All measurements are easily available in smartphones and PCs with proper analysis. But SCADA system is very costly and as if we think about money the cost of our project is very much less than it so if we want safe measurements in low cost, we can prefer our project. Also, in presence of SCADA System as an emergency purpose this project can be used.



II. RELATED WORK

Actually, this concept came to us when we visited a substation with all safety measures. In that substation we saw that workers taking a reading of various parameters. There we think if workers may get 100% safety then dangers can be avoided. So that we decided to make a system which can measure all the electrical parameters especially in high voltage substation where risk factor is large and that system can operate by Smartphone, Laptop etc.

We know the SCADA System which make our electrical system automated. Various electrical machines are working, analysing and measuring by just clicking a button. And as electrical jobs in present years, the placements in electrical designing are exponentially increasing. But set up for SCADA system is very costly and as the system s complex, it requires skilled operators, analysis and programmers to maintain SCADA System and also the system increases unemployment rates especially in this COVID-19 situation [3]. The installation cost of our project is very less than SCADA System. Also, the handling and execution of our project is simple than SCADA System. Our project system is easily understandable for employee so the problem of unemployment due to SCADA System which get reduced [3].

Allegro Microsystem is a company made a ACS712 [4]. It is a Hall Effect Based Linear Current Sensor it is measure both DC (Direct Current) and AC (Alternating Current) [4].By connecting the sensor in the series to the system we can find out the current value. ACS712 current sensor is in interface with Arduino Uno. By using this current sensor, we not need to check reading in meter, by using displays or in laptop we can see current values. In this we suggest if Bluetooth module add in this system so we can operate this ACS712 current sensor by Blynk Application in mobile. Even if this is a digital measurement and it is very beneficial, we should go with Analog because lack of isolation between the load and sensing part, non-linearity in the response of ACS712 current sensor due to Joule heating that drifts the resistance value [4]. It has low overload capacity and this is temperature sensitive device. Also, ACS712 current sensor is only for measuring the current but our project is applicable for any electrical parameter so that we named "Universal Analog Measurement".

III. COMPONENTS REQUIRED

Following are the components required:

- Arduino Uno
- MPU6050 Gyro & Accelerometer Sensor
- Bluetooth module HC-05 Pin
- ESP8266 Wi-Fi module (If required)
- PCB board
- Connecting wires

MPU6050 module is complete 6-axis Motion Tracking Device because it combines 3-axis Gyroscope, 3-axis Accelerometer and Digital Motion Processor all in small package [7]. The MPU6050 consist of 3-axis Gyroscope with Micro Electro Mechanical System (MEMS) technology [7]. It used to detect angle of tilt or inclination along the X, Y and Z axes. This Module is connecting with Arduino by using connecting wires.

Bluetooth module HC-05: -It is a serial Bluetooth module for Arduino and other microcontrollers. It is having operating voltage 4V to 6V (Typically +5V) [6]. The range for Bluetooth is 100 m. It can be easily interfaced with Laptop or Mobile Phones with Bluetooth. It is very easy to pair the HC-05 module with microcontrollers because it operates using the Serial Port Protocol (SPP) [6].

ESP8266 Wi-Fi module: - This is Wi-Fi serial transceiver module, based on ESP8266 SoC [5]. Arduino UNO and the compatible board can directly connect to this module [5]. It acts as messenger of long distance. we communicate to Arduino wirelessly using your phone (Android or iPhone). There are a lot of ways to use ESP866 for communication. Some may use it to send / receive data online or regularly upload data. This will be done offline so no need to have internet connection. The process is pretty simple. Use your phone to send any command to Arduino. With the help of ESP8266, everything will work wirelessly.

Blynk Application: - Blynk is an application that runs over Android and IOS devices to control any IoT based application using Smartphones[8]. It allows you to create your Graphical User Interface for IoT application. Here we

set up the Blynk application to monitor MPU6050 Angles over Bluetooth using HC-05 Module or Wi-Fi using ESP8266 Module [8].

IV. METHODOLOGY

Firstly, we were making an Excel sheet in Laptop which contain parameter readings for ex. Current readings of given Ammeter for respective angle as given in Fig. (1), i.e. Meter Reading Page. For measuring angle on ammeter scale, we can use Protector. Then we must attach MPU6050 Module to the needle head. After that programming part comes, now we should connect HC-05 Bluetooth Module or ESP8266 Wi-Fi Module to Arduino and do programming for it. Now by using Blynk application we can connect our smartphone with Arduino UNO via Bluetooth or by Wi-Fi.

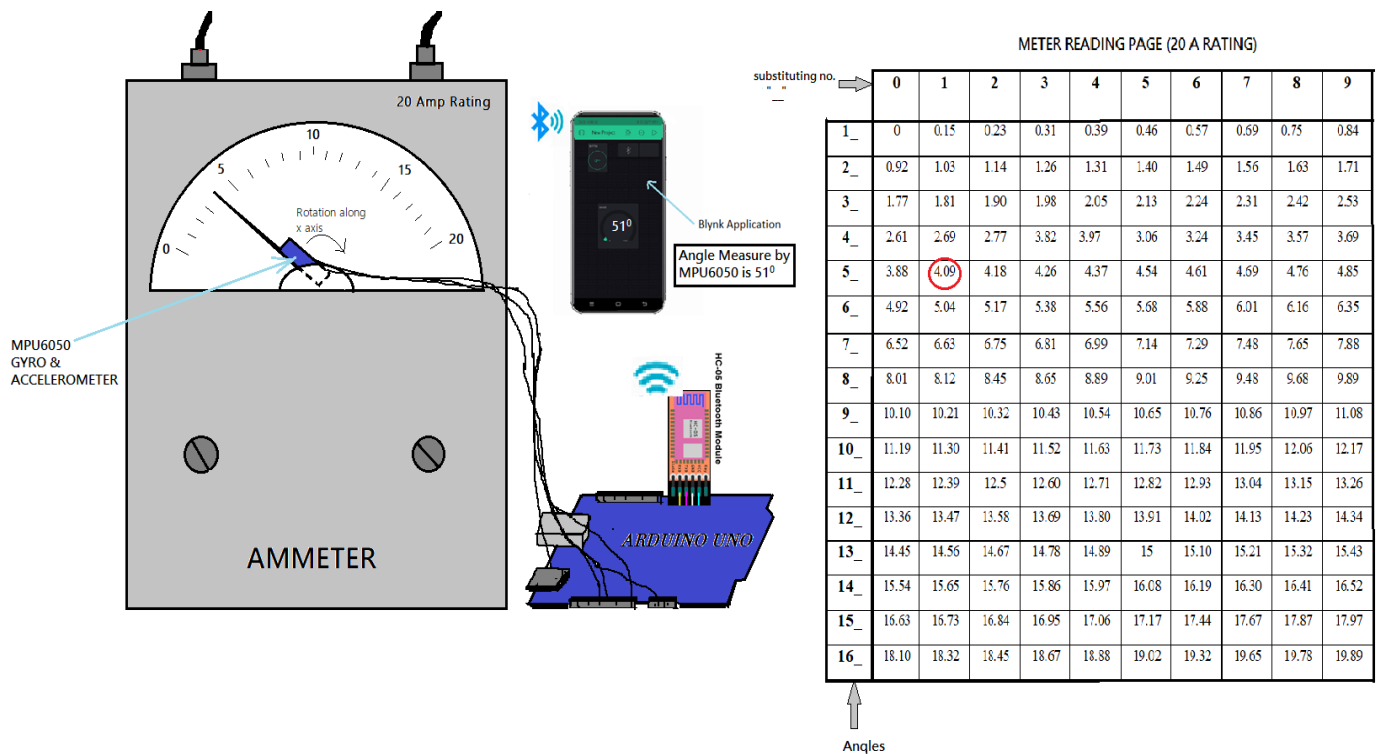


Fig. (1) Pictorial Representation of Working of the System

From above Fig. (1), it is showing how the system will work, in this we find the current value and for that we made a required connection and programming. In that Fig. (1) we can see the current is flowing through the 20A rating Ammeter so needle start moving and as per the connection MPU6050 Module which is connected to it that also moving along x axis. After some time, needle show a reading at one point and now by using Blynk application from our Smartphone we run the program and now it showing some angle value measured by MPU6050 Module and it is showing 51° in that application. Now we used “Meter Reading Page” which was made in Excel Sheet already according to current rating and saw that where is 51° in that table and check the respective current value for this angle. And finally, we get reading of current flowing through the Ammeter which is 4.09 A.



V. EXPERIMENTAL RESULTS

Parameters	At no load	At half load	At full load
		2/2/2021 2:46:56 PM	2/2/2021 2:34:21 PM
Real power	1.78W	78.52W	139.64W
Power factor	0.44	0.95	0.92
Voltage	232.39V	232.69V	231.63V
Current	0.02A	0.36A	0.65A

VI. CONCLUSION

So, our project defines the future scope along with the safety measure while using the analog instruments. In this world of digital, use of analog instruments plays a major role is being defined by our projects. People can take measurements anytime even if doing another work. The fact is these instruments can be used in high voltage substation so chances of risk factor will be reduced.

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