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Intelligent Strength Measurement Defelectometer

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ABSTRACT: The Benkelman beam instrument is used to measure the deflection of the road when loaded vehicle ispassing on roads. The deflection readings from this instrument is useful to decide the material used for roadconstruction as well to decide the thickness of overlay to lay on the road.This traditional method is very tiresome, time consuming and bulky also it requires the trained human resource as well skilled labors due to which this system becomes costlier. In this system, pen-paper is used to take reading and these reading is uploaded by operator manually to calculate the overlay and type of material used for overlay's human errors can occurs while note down of reading and data logging into computer So we proposed the Smart deflectometer, which measuring the road deflection using the resistive type sensorand gives digital display with help of microcontroller. The data reading and logging is done automatically by controller. These reading which is stored in our system will transfer via serial communication to computer system, where further process on this data can be done for report generation. The deflection measuring unit may be called as Smart Deflectometer and intelligence part is added by computer i.e. the calculation of the overlay by selecting the material for overlay.

KEYWORDS: Benkelman beam, Deflectometer , overlay designs,sensor,controller.

I.INTRODUCTION

The Benkelman beam instrument is used to measure the deflection of the road which further is use to decide thematerial used for road construction and thickness of overlay laid on road. The road deflection measurement using Benkelman beam method is very tiresome, time consuming, bulky and costlier. Skilled operators and labours arerequired to take this test. All readings and work is done manually which leads to human errors and it reduces the reliability of this system. So we proposed the Smart deflectometer, which measuring the road deflection usingthe resistive type sensor and gives digital display with help of microcontroller. The data reading and logging isdone automatically by controller. These reading which is stored in our system will transfer via serialcommunication to computer system, where further process on this data can be done for report generation.

Software present on computer, process these readings and calculates overlay thickness of flexible pavement andmaterial used for construction. It can have the facility to produce the reports date wise, sitewise, timewise and can also hardcopy of it.

Following are the main problems with the existing system which leads the necessity to develop smart deflectometer.

Beam is cantilever type, It is too hard to align the beam due to its long length .Beam is having mechanical sensor to sense the deflection which is very sensitive. The deflection is measured with gauge meter which is pointing device, it's troublesome to measure the deflections .Anyhow even though the deflections are measured one has to multiply it with the some constant factor.There are also many mechanical concerns that should be taken into the consideration like. Distance between the bearing ofthe beam & rear adjusting leg, distance between dial gauge & rear adjusting leg, distance

Between the front rear legs etc. As all the procedures of measurement is having a manual interventions, there is almost all probability of error per user .Also one has to perform all the calculations manually which is too exhaustive and error

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some .Reports are maintained on hard copy only, there is probability of damaging the data with age. Overall the system is not reliable.

II.SYSTEM MODEL AND ASSUMPTIONS

In this system, pen-paper is used to take reading and these reading is uploaded by operator manually to calculate the overlay and type of material used for overlay's human errors can occurs while note down of reading and data logging into computer So we proposed the Smart deflectometer, which measuring the road deflection using the resistive type sensor and gives digital display with help of microcontroller. The data reading and logging is done automatically by controller. These reading which is stored in our system will transfer via serial communication to computer system, where further process on this data can be done for report generation.

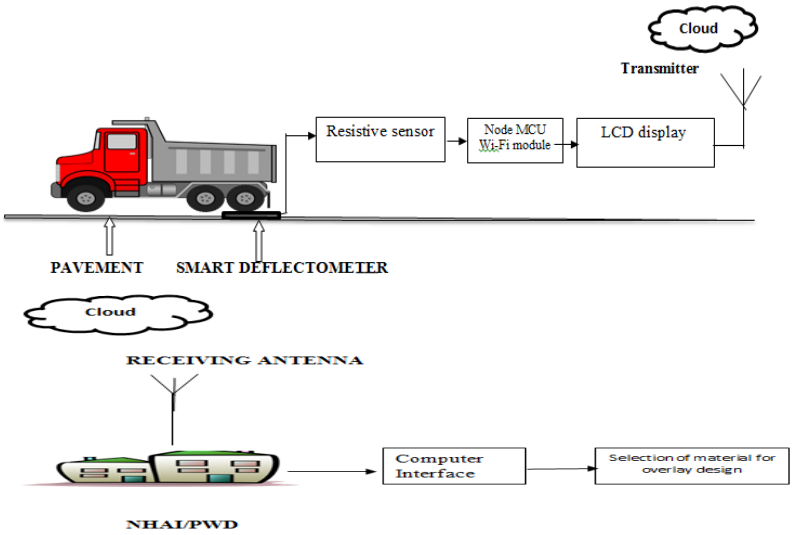

Fig 1 .Block diagram of proposed system

a)Resistive sensor, b) node mcu Wi-Fi Module, c) Lcd display, d) computer interface, e) selection of material for overlay design.[5]

a) RESISTIVE SENSOR

Linear potentiometers produce a resistance output that varies according to the displacement or position of a slider or wiper. They are variable resistors with three leads. Two leads connect to the ends of the resistor, so the resistance between them is fixed. The third lead connects to a slider that travels along the resistor varying the resistance between it and the other two connections. The resistance element is excited by either DC or AC voltage"Linear" can refer to the taper (law)-how the output voltage varies with the motion of the slider. A linear taper means that resistance increases in direct proportion to the distance traveled along the resistive element. This contrasts with a change in resistance via a logarithmic scale (a log or audio taper).

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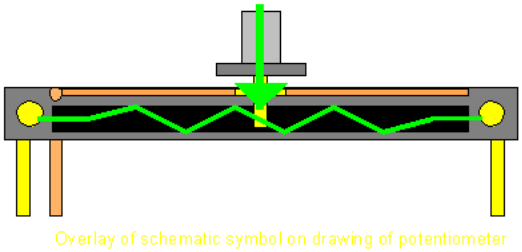

b) Node mcu Wi-Fi Module

The NodeMCU (Node MicroController Unit) is an open source software and hardware development environment that is built around a very inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains all crucial elements of the modern computer: CPU, RAM, networking (wifi), and even a modern operating system and SDK. When purchased at bulk, the ESP8266 chip costs only $2 USD a piece. That makes it an excellent choice for IoT projects of all kinds

c) Lcd Display

A liquid crystal display or LCD draws its definition from its name itself. It is combination of two states of matter, the solid and the liquid. LCD uses a liquid crystal to produce a visible image. Liquid crystal displays are super-thin technology display screen that are generally used in laptop computer screen, TVs, cell phones and portable video games. LCD's technologies allow displays to be much thinner when compared to cathode ray tube (CRT) technology.

d) Computer Interface

The deflections are saved in the Smartdeflectometer are loaded into the computer with the IOT. Same readings are taken from the computer for overlay calculations. These readings are nothing but the flexible pavement deflections recorded on cite. The software for the thickness overlay design is developed in Visual Basics 6.

e) SELECTION OF MATERIAL FOR OVERLAY DESIGN

By clicking on the Load data, the deflections (D) in mm are loaded on the screen, it calculates the summation of all D, mean of all D, standard deviation, and the characteristics deflection in mm. User has to enter the value of temperature, it will give the value of the characteristics deflection after the temperature correction.

Upon selecting the material used foe the overlay, correction factor R and the value of the allowable deflection Da, the software gives final thickness for the overlay in mm or cm.

User has to enter the cite name whereas current date and serial number of the cite is taken automatically through software.

Another feature of the Intelligent Road Strength Meter is that it produces the reports on demand. To fulfill this feature software gives two types of the reports i.e. according to the cite name and according to the date.

User has to select or give the date of which he is expecting the report to produce the date wise report.

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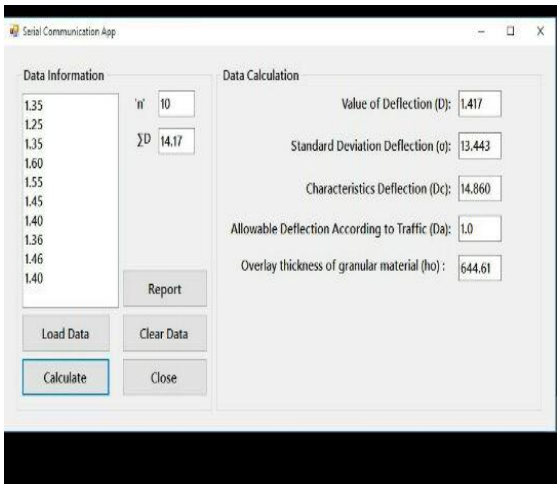
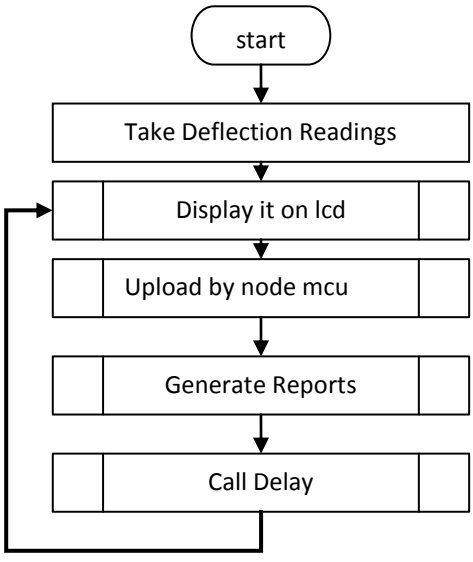


III. FLOW CHART



Main flowchart employee's different routines that executes role of different sections or system blocks to achieve expected task. Once port initialization, node mcu will upload readings will give the digitized data which is given to display through microcontroller according to the action of key pressed after considerable amount of delay.

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IV.TESTING OBJECTIVE

SOFTWARE SIMULATION

ThingSpeak is an IoT analytics platform service that allows you to aggregate, visualize and analyze live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by your devices to ThingSpeak. With the ability to execute MATLAB code in ThingSpeak you can
perform online analysis and processing of the data as it comes in. Some of the key capabilities of
ThingSpeak include the ability to: Easily con_gure devices to send data to ThingSpeak using popular IoT protocols.Visualize your sensor data in real-time.

Aggregate data on-demand from third-party sources.
Use the power of MATLAB to make sense of your IoT data.Run your IoT analytics automatically based on schedules or events.Prototype and build IoT systems without setting up servers or developing web software. Automatically act on your data and communicate using third-party services like Twilio or Twitter.Send sensor data privately to the cloud.
There are sensors all aroundin our homes, smart phones, automobiles, city infrastructure,and industrial equipment. Sensors detect and measure information on all sorts of things like temperature, humidity, and pressure. And they communicate that data in some form, such as a numerical value or electrical signal.

A.PROCESS OF DEFLECTION MEASUREMENT

Visual Basic .NET (VB.NET) is a multi-paradigm, object-oriented programming language, implemented on the .NET Framework. Microsoft launchedVB.NET in 2002 as the successorto its original Visual Basic language. Although the ".NET" portion of the name was dropped in2005, this article uses "Visual Basic [.NET]" to refer to all Visual Basic languages releases since2002, in order to distinguish between them and the classic Visual Basic. Along with Visual C#, itis one of the two main languages targeting the .NET framework.Microsoft's integrated development environment (IDE) for developing in Visual Basic .NET languageis Visual Studio. Most Visual Studio editions are commercial the only exceptions are Visual StudioExpress and Visual Studio Community,

B. SPECIFICATIONS FOR MEASUREMENT

Condition survey and deection data are used to establish sections of uniform Performance.
At least 10 deection measurements should be made for each section per lane subject to minimum of 20 measurements per km.
If the highest or the lowest deection values for the section di_er from the mean by more than one- third of the mean, then extra deection measurement should be made at 25 m on either side of point where high or low values are observed.

C. ADVANTAGES AND UNIQUENESS

a)ADVANTAGES

- The system will give measured deections directly in mm. so no need of any multiplication
- factor.
- The system is having facility to load the saved reading into computer, it is possible to have
- further calculation of overlay design automatically.
- It saves time and human e_ort.
- It is much more accurate than conventional beam technology.
- Low

b)UNIQUENESS

It provides simple user friendly operation
It can lead to modernization in transport road testing system.
With the help of digital readings human errors is avoiding
Report generation after testing is faster.
_Quality of road can be improved using correct test measurement.

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V. RESULT AND DISCUSSION

CHALLENGES

Being a new technology that is hardly used, but along with the applications and all the advantages there are also certain challenges faced by us, these challenges which can be overcomed by certain research and enhancement.

- Errors due to resistive type sensor

In the measurement of flexible pavement deflection, deflection is sensed with electronics or resistive sensor where as in Beam method deflection is sensed with mechanical sensor which is nothing but the canti liver beam
The deflection changes as the resistance changes by means of the shift.The cable connected between the sensor output and meter causes increase in resistance.
An EMI interference may cause error if the cable connected between the sensor and the matter is not properly shielded.

2. Data combination

IoT will produce lot of different types of data. Vast security policies will be involved for combining these data for providing more relevant data, which requires much complex user profile. Also these activities can put security of users at risk.[10]

1. Conflicting market interest.

By providing correlated data form various sources IoT will lead to a very competitive market.Therefore, it will help to satisfy costumers'needs more efficiently. Hence to provide various techniques to secure the personal data of users will be the most important issue in combing and corelating. This aim should be satisfied by using low weight privacy this is considered as a challenges[10].

2. Data management

One most imporatnt issue is to manage the data. Cryptographic mechanisms and related protocolsa are the most efficient options to protect the data but at times it is not possible to deploy these techniques. Hence there should be different policies to manage the data regardless of the type of the data but for this implementation there is a need to change many existing mechanisms[10].

3. Continuous operation

The applications of Smart deflectometer are note similar to that of computers because computers have human to give them command but in the case of smart objects they hace to configure themselves without any human intervention, adjust themselves in any situations and also act independantly. [9].

4. Power supply

Smart object requires power for running them the. The important issue with the batteries and power banks is their size and weights and the next issues is that as the smart devices are increasing day by day there is a need to provide each device with energy and power for these generation of electricity is required from the environment which is a very small process[9].

VI.CONCLUSION

As all existing procedures of measurement are having a manual interventions, there is almost All probability of error per user. Also one has to perform all the calculations manually which is too exhaustive and error some. Using proposed system, these errors can be minimized to some extends also it also helps to develop cost effective system which will gives accurate result of material being used for construction and to calculate accurate the thickness of road overlay, due to which the cost required to construct or maintain the road can be minimized.

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