Feasibility Study

Stitch quality checking at needlepoint

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1. Introduction

1.1 Overview of the Project

Computer vision based solution to automate the process of checking the quality of the stitches according to the standards Detect stitch quality as early as possible, that is at needle point of the sewing machine. If quality of the stitch is low, it should be notified to the team member who is using this machine

There will be a camera module attached at the top of the swaying machine. That camera captures the image feed and send to a raspberry pi. Images are processed at the raspberry pi. If there is a defect in particular image immediately alert the user of that swaying machine. At the mean time that image will be fed to a post processing stage and detect the type of the defect. All the images which have detected defect will be saved in a database with date, time, user and other relevant information.

1.2 Objectives of the Project

- Get the footage of the stitches
- Detect the defects
- Notify the user
- Keep a history of detected defects
- Classify as the type of the defect

1.3 The Need for the Project

This project is from MAS Holding which is a leading company in textile industry in Sri lanka. Company need to extent their quality of the products using latest technology in the world. There are several types of defects happens in the stitches.

- Slipped or skipped stitch
- Staggered stitch
- Unbalance stitch
- Variable stitch
- Thread breakage etc.

So the company needs to avoid those stitches defects on their products and increase the quality.

1.4 Overview of Existing Systems and Technologies

Stitch quality monitoring system for sewing machines - 1996

By Robert N. Cox, Timothy G. Clapp, Kimberly J. Titus

Stitch quality monitoring system for use in combination with a sewing machine having one or more stitch threads and comprising sensor means for at least one of said one or more stitch threads for detecting thread motion during each sewing stitch cycle. Encoder means is operatively associated with the sewing machine for creating a predetermined constant number of sensor means sampling signals for each stitch cycle of the sewing machine, and circuit means is electrically connected to the sensor

means and encoder means for detecting stitch defects during the formation of potentially defective stitches.

Stitch quality monitoring system - 2009

By Theodore J. Stokes, Matthew Paul Sherman, Kenneth Mark Eubanks, Paul Truman Statler, Joseph W. Bauman

A stitcher is provided that includes a needle configured to place stitches in a fabric that is moved therethrough. The stitcher includes a sensor positioned below the fabric to monitor stitches placed in the fabric. A microcontroller is provided configured to receive data from the sensor and, based on such data, to compare one or more attributes of the monitored stitches with one or more predetermined parameters relating at least one attribute of the fabric. The predetermined parameter may be either hardcoded inn the microcontroller or input by a user of the stitcher prior to beginning operation of the machine. When the attributes of the monitored stitches fall outside of the predetermined parameters, the microcontroller initiates notification of the user.

1.5 Scope of the Project

This system can be used with a swaying machine with attached camera module and the embedded device. There are 2 types of uses of this system.

1. End user : user who is get the services of the system.

2. Admin user : user who is responsible for the ML model and niotification system.

1.6 Deliverables

- Embedded devise with a camera module attached to the swaying machine.
- ML model to detect defects in the stitches.
- Classification model to classify the detected defects according to the type of the defect. (for the 2nd phase)
- Database to keep records of detected defects in firebase. (for the 2nd phase)

2. Feasibility Study

2.1 Financial Feasibility

This system has a raspberry pi 3 micro controller, a camera module. Those components costs around LKR 10,000. Defect detection model is implemented in raspberry pi. Cost of that model is reduced. Classification model in the 2nd phase must be hosted in a cloud. That will cost some amount. Database service which is going to use can be get free of charge from firebase. So the project is financially feasible.

2.2 Technical Feasibility

Raspberry pi 3 boards are easily get from the department for the project. But the camera module which suits for this purpose must buy some where else as it needs manual focusing, fair frame rate and other relevant features. That can be managed. All the developing tools such as keras, tensorflow

are freely available. Development environment tools such as vs code, raspbian os are freely available. So the project is technically feasible.

2.3 Resource and Time Feasibility

Main issue in the resources is getting a better data-set to train the both models.

Time frame of 11 weeks is a very challenging as project need more time for the do researches, collect data for the data-set. To manage that issue the project is divided to 2 phases. In phase 1 works with the defect detection model and the notification system. Classification model and the database implementation will be done in phase 2.

2.4 Risk Feasibility

There is a risks on hardware malfunctioning. So it is sufficient to get error free, well functioning hardware components to avoid those risks. Machine learning model must be trained with enough data to perform its predictions perfectly. Getting those data sets will be a challenge when the system is under developing in limited time period. It can be managed by the available data sets with a fair accuracy.

3. References

Firebase - https://firebase.google.com

Keras - https://keras.io/

Tensorflow - https://www.tensorflow.org/

Raspberry pi - https://www.raspberrypi.org/