SIF Alpha Project Registration

Date of Submission

Oct 2022

Project Reference Number

10037420

Project Registration

Project Title

Predictive Safety Interventions - Alpha

Project Reference Number

10037420

Project Licensee(s)

SGN

Project Start

Aug 2022

Project Duration

6 Months

Nominated Project Contact(s)

stuart.sherlock@sgn.co.uk

Project Budget

£498,618.00

Funding Mechanism

SIF Alpha - Round 1

SIF Funding

£411,086.00

Strategy Theme

Data and digitalisation

Challenge Area

Data and digitisation

Project Summary

Worksite safety in the utilities sector has plateaued for 8 years.

Utility companies are facing the challenge of reducing costs, while improving standards of service to customers and employee safety. At least 10,000 working days were lost to injury in the sector in 2021. The network cannot afford the continued disruption.

Currently, the process for reducing lost-time injuries involves a large manual data-capture effort and experimental process changes. By the nature of this process, a worksite is already unsafe before anything is done to prevent it.

Instead of waiting for a site to become unsafe, FYLD and SGN want to analyse which conditions contribute the most to worksite safety, then multiply them throughout the network.

In 2021 SGN field teams recorded more than 31,000 video risk assessments using FYLD's AI-assisted technology, leading to a 20% decrease in safety events and £2.9m realised in related benefits. Of the safety events recorded, ~20% were failures to make the site safely accessible for teams and members of the public.

FYLD's vision is to assist every fieldworker to take corrective actions and put unsafe conditions right in real time, before they develop into something more serious.

During the Alpha phase, FYLD will build a machine-learning model to assess how effectively site controls have been deployed and determine which strategies lead to the safest outcomes. This model will be used to power an augmented reality proof-of-concept that will demonstrate how interventions can be made in real time -- with significant benefits to workers and members of the public.

In the SIF discovery phase, FYLD set out to determine whether the risk assessment data could be used to forecast the potential risk of a safety incident. We found a statistically significant inverse correlation between the number of risk assessments recorded and safety incidents logged. We tested 15 predictive machine-learning models and two showed potential - in both cases, recall surpassed the 50% threshold on multiple occasions.

However, we discovered that risk assessment data, alone, doesn't give the full picture. Fieldworkers at different sites can record nearly identical risk assessments, but only some of those sites will result in a safety event. This pattern presents even where the same control measures are, theoretically, applied to the same degree.

That's where the opportunity lies.

The earliest point that an intervention can be made to improve site safety is the moment after a risk assessment is completed.

Making worksites safer will improve the efficiency and resilience of the network, reducing time lost to injury and the disruption caused when incidents occur. SGN saved £240,000 in fines, in 2021, by simply recording evidence from the worksite.

SGN have been working with FYLD since the company's inception. In 2021, SGN realised £2.9m in benefits through using FYLD and both companies have recently entered a three-year innovation partnership targeting a further £16m in savings. At the last count, just over 2800 people at SGN are already using FYLD -- this has resulted in more than 143,000 point of work site assessments.

FYLD are best placed to assist SGN and bring this solution to market:

1. A high-performing team with experience launching and maintaining AI/ML products
   A demonstrable history of realising significant cost savings for utilities companies by deploying innovative solutions
   Existing technology and datasets that can be built upon
   In-house experience and expertise in change-management required for digital transformation, specifically within safety and productivity of utilities companies, at scale

Project Description

FYLD and SGN have partnered to build a predictive safety system that will analyse which actions contribute the most to worksite safety and productivity, then amplify them across the network.

Safe streetworks are cheaper, less prone to delay and more accessible to members of the public. However, despite advances in technology, worksite safety in utilities has plateaued for 8 years - last year 15 people died and 2009 were unable to immediately return to work due to the injuries they sustained. The current strategies to improve this involve significant manual data capture and analysis - often predicated on projections and guesswork.

Companies across the sector are at different stages of the safety journey; some have a well-established culture of sharing learnings from safety events internally, whereas others are still trying to incentivise their teams to report incidents. There is no established protocol for sharing their findings between companies, making safety an unfair competitive advantage.

Predictive Safety Interventions will enable fieldworkers to document everything that contributes, positively or negatively, to worksite safety - then help them to take course-correcting actions when risk starts to increase.

Our vision is that every fieldworker makes it home safely, every day.

FYLD and SGN will show how technology can improve the fidelity of the data capture process via the FYLD app and body-worn cameras, then use machine-learning models to assess how each input and outcome affects the risk score. Like the workforce, the model will require ongoing training and, as the datasets grow, we will develop a method to train both (our model and the people using it) at the same time. As the model continues to learn, the interventions will continue to improve. However, unlike before, fieldworkers will learn from the actions of all of their colleagues from across the entire sector.

The earliest point that an intervention can be made is the moment after a risk is recognised. The PSI model will be used to power an augmented reality proof-of-concept that will demonstrate how interventions can be made in real time.

Preceding Projects

10027191 - Predictive Safety Interventions

Nominated Contact Email Address(es)

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Project Approaches And Desired Outcomes

Innovation Justification

The current strategies for reducing safety incidents aren't working.

One of the oldest safety theories is the Accident Triangle, which Is sometimes compared to an iceberg, where the visible part consists of reported injuries and fatalities, and the invisible part under water are all the unreported incidents and near misses. If you can capture the indicators, you can run experiments to reduce them -- reducing the more severe incidents that may occur as a result.

However, indicator events are significantly underreported. A number of modern, data led studies also question the validity of the accident Triangle (Marshall et al, 2018 and Moore et al, 2020).

In 2021: SGN had a shortfall of ~85,000 reports, capturing just 2% of what we estimate they should be; Thames Water (a company about 5 years ahead on the safety journey) captured 60% of the estimated events, but still had a shortfall of ~80,000 reports; The utilities industry (as a whole) should have recorded 33.6m indicator events

The reporting process is manual, difficult to train or incentivise and leads to inconsistent and low-quality data. Fieldworkers are busy and their workplace is distracting -- in SGN's case, the average description is just 260 characters long.

It will take years to address the delta, before any meaningful insight can be gleaned from it.

SGN are currently trialling methods to address the data delta; basing individual performance on the number of hazards and near misses reported by each individual.

However, Chris Trodd, the Head of Safety at SGN, is seeking a technological solution to capture this data in the long term, "When someone does a task repeatedly, they can't see the near miss they've missed. That's where machine-learning and [object-recognition] could come in. [It] presents the opportunity to say, 'just before you go and do that - is it such a good idea?'"

Rather than relying on fieldworkers to manually report safety events in the hope of preventing them next time, we believe technology is better placed to:

- Capture high-fidelity data; object recognition models can be trained on footage from body-worn cameras
- Recognise patterns in the data;
- Test strategies to lower the risk, at scale;
- Make Interventions in real time automatically triggered when thresholds are met

The combination of object-recognition and natural language processing used in FYLD's VRA technology has changed point-of-work risk assessments from a box-ticking exercise to a critical method for sharing up-to-date information about the worksite and driving behavioural change from the first time it is used by a field worker. Applying these same methods to the controls and outcomes will provide a real-time view of risk. By overlaying contextual data from other sources -- location, weather, traffic -- FYLD will also determine how these factors contribute.

By capturing the risks, controls and outcomes of all fieldwork in FYLD, our model will be able to:

- Assess the real-time risk of every worksite
- Determine the efficacy of controls in place to mitigate the hazards
- Suggest interventions that have provably lowered risk elsewhere
- Record outcomes and learn which strategies are most effective
- Share the findings between all parties involved

Benefits

There are three key areas where financial benefits will be accrued:

1. Reduction of injuries and incidents and flow on impact to better management of network operations
2. Lower cost to capture data about indicator events
3. Reduction in fines (associated to permit condition breaches)

It would take

1) Reduction of lost-time injuries

The cost of lost-time injuries in the utility sector 2021 amounted to \>£125m. In 2021, SGN field teams recorded more than 31,000 video risk assessments using FYLD's AI-assisted technology, leading to a 20% decrease in safety events.

We hypothesise that FYLD's Predictive Safety Interventions will be able to make at least an additional 20% reduction in lost-time injuries. Discounting the additional savings related to reducing fatalities and other injuries, the total projected savings made possible amount to £59,201,640.00.

2) Lower cost to capture data about indicator events

Based on the number of lost-time injuries (LTIs), SGN should have reported 85,072 indicators.

It will cost SGN an absolute minimum of £280k (just considering field worker time, and not including program management) per year to address the data delta manually:

- 85,072 indicators to report
- 6 minutes per report (conservative estimate, likely takes longer)
- £0.55 per minute weighted average salary

We estimate it will cost the utilities industry ~£58m to record enough indicator events to have a meaningful impact on more severe incidents. This doesn't include the cost of training the workforce, analysing the data or the significant changes required to transform the safety culture.

FYLD helped SGN save 10,400 field work hours (across ~375 FTEs) in a year by transforming a paper-based process into an AI-analysed video recording.

In the alpha phase, we will determine how effectively the combination of body-worn cameras and an OR/NLP model could reduce the time taken to report an indicator event.

Risks And Issues

he project presents several risks:

1. Technical risk - this is ground breaking research
2. Human behaviour and change management
3. The viability of a scalable product
4. Enforcement of standards
5. Regulation and unions

1) Technical risk

While the early results of the discovery phare are encouraging, the work is deeply experimental and is not yet proven. The project KPIs will be carefully monitored through regular governance sessions.

The high-technology component of the project (Augmented and Virtual Reality) will also require additional skills and hardware, we'll need to augment the team with specialist new skill sets.

2) Human risk

The Accident Triangle has been a safety paradigm for nearly a century. What we're proposing could fundamentally disrupt that model and there is a risk around the timeframe for HSEQ professionals to trust our solution.

SGN's Executive teams are bought into FYLD's vision and will provide strategic and operational assistance to ensure the objectives of the alpha phase are met. By partnering with SGN, FYLD will create a case study for the benefits that can be realised by this assistive technology. The FYLD team will also engage other FYLD customers to publicise all developments during the Alpha phase, as a precursor to expansion of the trial with other customers.

3) Product risk

There is questions of whether the required machine learning model can be built and deployed into product in a scalable way, across organisations or industries, or whether the solution is a bespoke algorithm for each different type of work that goes on within a utility.

FYLD hypothesise that the core predictive model will take input from all customers, powering a tailored component that enables customisation for each company (to account for their unique processes). The feasibility of this will be determined during the alpha phase. We are confident of our ability to achieve the outcome, but the high-risk nature of the activity is also clear.

4) Enforcement of standards

There is a unique opportunity to develop a standard protocol for reporting hazards, controls and incidents (through the innovation partnership between FYLD and SGN and FYLD's relationships with other customers) but neither party are able to mandate or enforce this across the wider industry.

5) Regulation and unions

SGN is obliged under the Health & Safety at Work Act to provide a safe place for its employees to work. The HSE has taken a presentation on FYLD during 2021 and its deployment of AI to enable safer work places was positively received. In due course we will engage with HSE on this new area of development and expect it will also be positively received.

We have proactively engaged the HSE's Science and Research Centre who are currently running a 'Discovering Safety' programme, with similar goals to that of this project, seeking partnership.

To date, unions have positively received the deployment of FYLD, including the proactive fatigue management module which captures working hours and other detailed shift information for analytics. We have proactively engaged the union about how FYLD is an enabler of work site safety and will continue this approach to ensure that they are supportive.

Project Plans And Milestones

Project Plans And Milestones

FYLD's Predictive Safety Interventions (PSI) will be developed by FYLD and rolled-out to SGN field teams with support from operations and safety managers at SGN.

There are two deliverables, which will be developed in parallel:

1. A predictive model to calculate the real-time risk based on multiple inputs; An augmented reality proof-of-concept that demonstrates real time interventions.
2. The project will be managed by project leads at FYLD and SGN, with governance from executive sponsors on both sides. Both teams will meet on a weekly basis to monitor the progress of the project. The payment schedule will be monthly.

Milestone 1

The objective of the first milestone is to build upon the work done in the Discovery phase. We'll capture the proprietary data necessary to train a risk prediction model, enrich it with data overlayed from other sources and continue to test the Naïve Bayes and Logistic Regression machine-learning models for their risk-prediction capability.

M1 deliverables:

1. Add incident reporting and control evidencing to FYLD's core app and begin building a data set: Add incident reporting and control evidencing capability to FYLD's app (to capture data from all customers); Deploy body-worn cameras with a number of SGN teams to capture safety events as they happen
2. Begin the development of machine-learning models: Create a natural-language-processing (NLP) model to interpret safety events from video and audio inputs; Develop upon FYLD's object-recognition (OR) model to recognise 3 or more controls
3. Assess the predictive capability of the model(s) with data gathered from each source

The success criteria for milestone one are:

1. Accuracy of NLP interpretation surpasses 60%
2. Accuracy of OR model surpasses 60% for 1 or more controls
3. Accuracy of one of the predictive models consistently surpasses 50%

Milestone 2

We'll begin the second phase of work by selecting a predictive model to move forward and begin developing a production-grade version. At this stage, safety event data should be accumulating at a good pace, and we will need to develop the method(s) to categorise it -- before it can be used to train the model.

M2 deliverables:

1. Develop method(s) to categorise control dataset into degrees of efficacy; Build functionality into the FYLD app(s) to enable categorisation at scale
2. Identify the method(s) for sharing recommendations to improve the controls and determine how effectively they lower the risk level of a worksite
3. Overlay contextual dataset(s) and assess their relationship to safety risk (Provided that (1) we can get good data and (2) they add any predictive power): Location, Weather, Traffic etc.

The success criteria for milestone two are:

1. The accuracy of predictive model is demonstrably increased with larger training datasets
2. Suggested improvements for controls can be delivered to field teams after controls are evidenced
3. The efficacy of controls before and after the suggested improvements can be quantified

Milestone 3

In this milestone we'll demonstrate how real-time interventions can be made by developing an augmented reality proof-of-concept to demonstrate how the predictive model can be used to lower safety risk in real time.

M3 deliverables:

1. An application that runs on Microsoft Hololens 2 headsets that can recognise ineffective controls and suggest corrections in real time.

Success criteria for milestone 3:

1. PoC can demonstrate at least one control improvement in real time, e.g. improving public accessibility of worksite

We will require the following additional resources:

- For milestone 1&2: Body-worn cameras to build incident database; Support from SHE managers at SGN to categorise and label the datasets
- For milestone 3: Hardware and software to support the development of an AR app; Additional technical expertise to develop the AR app

Regulatory Barriers (Not scored)

SGN is obliged under the Health & Safety at Work Act to provide a safe place for its employees to work. The HSE has taken a presentation on FYLD during 2021 and its deployment of AI to enable safer work places was positively received. In due course we will engage with HSE on this new area of development and expect it will also be positively received.

Business As Usual

Upon completion of the project, and if the accuracy thresholds are met, FYLD adopt this project into business-as-usual by:

- Roll out the in-app event reporting and data categorisation features to all FYLD customers as part of the core app experience; this will enable all licensees to benefit from data captured by all parties and enable customers who aren't yet using the predictive model to begin capturing proprietary data that will work with the predictive model when they're ready to purchase the capability
- Create a case study based on the trial with SGN, to demonstrate the benefits to other potential licensees
- Soft launch the predictive model in a commercially sustainable manner, ramping up its capability and presence across FYLD's product suite as confidence in the predictions grow
- Launch a commercially sustainable product/service layer to visualise the data and insights gleaned from the data
- Organise demonstrations of the proof-of-concept; directly with other FYLD customers, at appropriate events and conferences

The FYLD team responsible for the delivery of this project consists of:

- John Haynes is FYLD's Strategic Design Lead and will be leading the project, overseeing the end-to-end research and development of both deliverables over the 6 month period. John leads FYLD's product labs team and led the discovery phase of this project. John has over 8 years' experience designing and launching digital products.
- Shelley Copsey is FYLD's CEO and the executive sponsor for this project. Shelley has a strong history of commercializing early-stage data platforms, including during her tenure as New Ventures and Commercialisation Leader for Australia's world-renowned science agency CSIRO.
- Mike Orley is FYLD's Innovation Partner Lead and has more than 8 years experience overseeing change management within safety teams as a former inspector for the HSE and as HSES Director at Centrica.

FYLD's AI/ML experts:

- Dr Ylenio Longo is FYLD's Senior Machine Learning Engineer and oversees the development of our AI/ML models. Ylenio has a background in statistics and machine learning, both in academia and industry.
- Dr Fang Chen is a special advisor to FYLD. She has vast experience in many industry segments and governments in leading digital transformation, especially using AI/data science to harness the power of data, provide evidence-based decisions and automation.

The project team will be complimented by FYLD's development team

SGN's contribution to the delivery of this project includes:

- A commitment to rolling out bodycams with 10 two-person teams; along with the operational support required for doing so
- Attendance to weekly governance sessions, with invitations for; Project lead(s), Executive sponsors, AI/ML experts, Safety team(s)
- An online portal, where all parties can keep track of the project roadmap, milestones and deliverables.

The ongoing cost of continued development and maintenance of the predictive model and proof-of-concept would form part of FYLD's BAU.

Commercials

Commercialisation

Where the alpha project results in a scalable, effective model being built, it is FYLD's intention to commercialise the outcomes of the

alpha model which will be available to its core target market (utilities and their supply chain) and other growing segments (rail, highways, airports) through licensed use of the FYLD platform. This will enable the entire UK utilities industry to achieve the projected cost savings in their operational models.

Due to the machine learning capability, the core model will be trained using inputs from all FYLD customers. This process expedites the model training and enables every customer to benefit and learn successful de-risking strategies from one another. Without a shared dataset (and a method to utilise it), companies with mature safety reporting processes will have an unfair competitive advantage -- and safety should never be a competitive advantage.

The network will benefit from less time lost due to injury and incidents, which has a flow on impact to continuity of customer services (ie the gas keeps flowing) and better completion rates for work. Utility companies will have visibility of a new dataset, where they can robustly quantify how effectively their mitigating controls impact risk for the first time. Through the proof-of-concept, we'll demonstrate how further gains could be made via fieldworker productivity.

However, the first step remains conducting further research to prove out the early findings of the Discovery phase, and then the ability to deploy this model at scale to multiple customers. FYLD is applying for this funding as it is a financially secure company (having recently secured £10m of funding in its Series A funding round) however it is now working towards delivering the metrics that will enable it to secure its Series B funding round. The successful application of grant proceeds will allow it to expedite this highly important and impactful part of its project roadmap, accelerating the transformation of the utilities industry.

The calibre of the entire FYLD team has recently been demonstrated at the Energy Innovation Awards where FYLD secured two wins -- one for its groundbreaking AI driven point of work risk assessment, the second as innovator of the year.

Intellectual Property Rights (Not scored)

The intellectual property and licensing arrangements associated with the Project will remain open and transparent because:

- Interested parties will be provided with a trial license to FYLD, immediately enabling them to understand the risk of their own worksites.
- All organisations that opt-in to use FYLD will also consent to sharing their data to the anonymised pool. If required, we'll use methods (such as homomorphic encryption and differential privacy) to ensure that anonymity is maintained, while maintaining the ability to drive meaningful insights between parties.

Costs and Value for Money

The total cost of the Alpha stage of this project is £498,618.

88% of the total project costs are attributed to FYLD, accounting for true value of the resource required to deliver this project (costed based on the day rate derived from annual salaries) and the cost of additional contractors (whose skills and expertise are crucial to the governance and delivery of the project) and the costs of necessary hardware. All hardware costs include VAT and are based on quotes or pricing at the time of submission. Fees for consultancy are based on existing retainers, or quotes provided previously.

The remaining is attributed to SGN (~12%) and to the National Grid (<1%) to cover the costs of labour required to manage the project and attend governance sessions.

Total funding requested is shared between the two deliverables:

- £356,847.64 total costs to produce the predictive AI/ML model (of which £215.235.00 FYLD labour, £49.998.00 attributed to consultancy/governance from Dr Chen, £49.998.00 contingency for additional HSE/AI consultancy, £5,000.00 cost of licenses associated to data source APIs, £15,600 Body worn cameras for data capture; estimate based on current pricing, inc. VAT)
- £97,214 total costs to produce the AR proof-of-concept (of which £78,000 Consultant fees for AR development; estimate based on 10 days per month at £650/day, to help deliver the proof-of-concept AR application for the Hololens 2, £19,214 hardware and software Additional contribution(s))

The FYLD team are committed to providing additional resource, where necessary within the scope of the project plan, to match the value of at least 10% of the project costs. This will predominantly be used in the design and development of the proof-of-concept; this will include additional travel days (and associated expenses) to conduct research and ensure delivery of the plan.

The possible capability of the Predictive Safety Interventions AI model will provide additional functionality to FYLD's existing operational digital twin. If successful, there are numerous possible applications for the output of the model within FYLD's existing suite of products.

Supporting Documents

Documents Uploaded Where Applicable

Yes

Documents:

Application Submission - Predictive Safety Intervention - Alpha.pdf

SIF Alpha Project Registration 2022-10-03 6_03

SIF Alpha Project Registration 2022-10-06 4_14

10037420 SIF Alpha Close Down Report 2023-03-31 10_21

SIF Alpha Project Registration 2024-02-20 10_32

This project has been approved by a senior member of staff

☑ Yes